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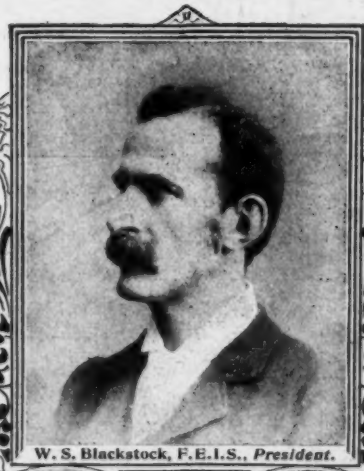

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A MONTHLY MAGAZINE AND REVIEW FOR THE SCHOOL-ROOM AND THE STUDY

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SOME PHYSICAL ASPECTS OF THE PUPIL.*

BY J. GUNN, M.A., D.SC.,

Author of "Class Teaching and Management," etc.

PART I.

HOW many of you, I wonder, have ever tried to train a young dog? I do not mean, to give him a technical education, so as to make him a good sheep-dog or a steady sporting dog; much less to give him a professional education such as to fit him for the stage, in circus or variety entertainments. I mean a good, plain elementary education, including the minor morals which every good domestic dog should observe, with perhaps a trifle of drawing-room accomplishments in the way of a time-honoured trick or two. How many of you have done, or attempted to do, this bit of educational work?

You need not answer my question; it is merely a rhetorical one, and not designed to collect statistics. The point to which I wish to lead up is this: those of you who have done so will be ready to admit that there is a great deal of human nature in a dog, and that a good many educational experiences of considerable value may be gained in the process of training one. The same remark, of course, might be made about any of the domestic animals or pets which we attempt to train; I only take the dog as the most common example.

If you are of a logical turn of mind, and not afraid of pursuing a train of thought that may seem whimsical or ludicrous, you may follow up this idea further. You may recall all that is said about teachers learning their trade at the expense of their pupils, and how much these latter suffer under the unskilful 'prentice hand. Why not make the ability to train a young dog one of the requirements for the "parchment"? What a grand test for patience, control of temper, insight into and sympathy with a less developed intelligence, steadfastness of purpose, and consistency of method! Let us have a *corpus vile* of less costly stuff than our children, and give the cabalistic letters *P. T.* a new meaning; instal "dog-training" in the syllabus as a "failing subject," and begin the new century on scientific principles.

Well, I cannot follow you quite so far as this: one gets conservative as one gets older. Besides, I have a great respect for dogs; and I have no wish to come under the ban of the Society for the Prevention of Cruelty to Animals. But I must confess that your idea would be not wholly unjustifiable, and your selection of a new subject for the syllabus might be rather more reasonable than some we may have heard of. On the whole, however, we may leave it as yet in the position of a voluntary subject, and recommend the issue of a special certificate, of course in three grades—elementary, advanced, and honours—with graded grants as per tradition.

Perhaps, even with this abatement, our pace has been too fast. So far from granting us our modest little reform, some critics may even wonder what is the grievance that we would cure in this whimsical fashion. Without further flippancy, and in all professional seriousness, I desire to impress on you that I think there is a defect or want of completeness in our training as teachers which may stand as excuse for this introduction. I firmly believe that as students we were not sufficiently impressed with the fact that *a child is an animal*. And yet I think I am right in saying that a child *is* an animal. I do not imply that we young teachers were advised to regard a child as an angel. Of course a child *is* an angel: you and I were children once, and we know all about that. Let us admit that there is some ground for the angelic view. But no one has suggested that view as a working theory for the teacher, and I am not going to suggest it now.

* Read at the Edinburgh Congress of E.I.S.

The question is, What view of child-nature *does* lie at the root of our training as teachers? What is *your* working definition of a child? Speaking from personal recollection, I think we used to regard the child as having a mind or intellect, built, so to speak, in watertight compartments called faculties, which were to be trained or developed in a certain order by certain subjects of instruction skilfully adapted by us for their development. We knew also that the child had various senses, and that some of these were of importance in education. And then we knew, as a matter of inference, that the child had a body; for we were skilled in the principles, if not in the practice, of corporal punishment.

Looking back on all this, I am ready to admit that our education was excellent so far as it went, but I am not so sure that it was adequate. We knew a great deal about education—I hope you will believe this—and a great deal about the teacher, but very little about the child. We never realised that there was anything to learn about him. What we learned by experience afterwards came in a haphazard kind of way—useful, but again, I fear, inadequate. Certainly never, except in moments of irritation, did we venture upon the proposition, "A child is an animal." And yet, I think, if we had been bold enough to formulate this statement, not in our haste, but in all seriousness, it might have led us to some useful results.

But surely, you will say, a child is more than an animal. The mind is infinitely higher than the body, and therefore the care of the mind is our highest work. I grant this readily, and a good deal more of the same tendency. But before we begin training and developing the mind, let us ask seriously how we are to get at it. My mind and your mind are entirely isolated from each other. The direct and close communion of mind with mind is, in our present state, entirely impossible. So long, at least, as we are in the body, we are doomed to solitary confinement. We are each shut up in a prison-house of flesh. We cannot speak to one another directly—thought answering to thought. We are obliged to fall back upon a code of signals—some of them natural signals, like the marks of feeling and emotion; some of them artificial or conventional signals, which we call language. And these signals, every one of them, are *physical* facts, not mental; they are made and received by means of our animal nature.

You may regard education, then, largely as dealing with these physical symbols of thought. The child learns the meaning of the signals we make—our gestures and our words, both spoken and written. He learns to use similar signals to express his thoughts. And, in addition, he acquires new thoughts from the teacher, which would not have occurred to him but for these signals. Everywhere, therefore, the animal or physical comes in as the medium of communication between mind and mind. And surely it is evident that the first duty of the teacher is to know, and know *thoroughly*, this physical apparatus and its capabilities. The higher you value the intellect, the greater necessity you lay upon the teacher to know the body.

I have spoken of the child as body and intellect only, and so far I have regarded the body as merely the apparatus of the intellect. But this view is far from complete. The test of our work on the child is not what he knows, but what he *does*; not his understanding, but his *conduct*. And in the view of conduct the body is not merely an apparatus. The mind is not always master of the body; the body asserts itself as an integral part of the human being. And so the child becomes a terribly complex thing, not to be defined easily—not to be defined at all, perhaps. Yet we dare not, as practical men and women—we *dare not* rest content with speaking of him as merely having a mind to be trained and developed.

And now let me become a little more practical if I can. Lofty theory is so easy, and everyday practice so difficult. As teachers, we have the child in school. But we have not got him in the singular number, unfortunately. His plurality is undeniable—embarrassing, perhaps, not only to teachers, but even to School Boards. His extreme plurality is not to be ignored.

The essence of school teaching—at any rate its *differentia* as compared with other teaching—is just this, that we must deal with the child in his plurality. And for this end we classify him. In fact, we may say that, *directly*, it is not the child we teach, but the class; the child also, but indirectly.

What is a class, then? Shall we call it a group of children at the same stage of intellectual development, so far as we can judge? I think intellectual development is our test. Age we can now ignore in our classification; and as for moral development or physical development, I think they too are ignored in most cases. I have not heard of children being classified according to moral progress in school; and I do not know that any of the excellently-equipped Board schools of this city have the apparatus for weighing or measuring or otherwise testing physically the children who are to be admitted, say, to the senior department.

Such a physical test is not even required for the Labour Certificate; will any sane educationist say it would be absurd to apply such a test to children leaving school to begin work? Is the work to be done by those who pass for Labour Certificates work which requires mental ability rather than physical? or are these children all so well grown that a physical test would be a mere matter of form and a waste of time? If it were only a puppy we had to certify for employment in some canine profession, I think we should look to his bone and muscle as well as to his intelligence. But let that pass meantime.

We have defined a class as a group of pupils of equal mental development. But our class is to work together as a unity for a whole year at least; and at the end of the year they should still be a class—that is, they should then also be at the same further stage of mental development. Well, if that is our aim, I think we must revise our definition somewhat. We must add that the class is such a group as to be capable of *equal progress* in mental development. That is not a distinction without a difference. It introduces a totally new element into our classification. How can we foretell the capabilities of our pupils even for one year? You may say it is absurd to attempt it.

And yet, by putting fifty pupils in a class to do the same work day by day, you really assume that you know they will advance equally. Or, to keep out the element of prophecy, how do you know they *can* do the same daily amount of mental work?—I do not mean exactly the same, but as nearly the same as good classes usually do.

In this matter I think we all fall back on the guiding principle known as the "rule of thumb." Even in these days of education as a science, of university chairs of education, and of proposed faculties of pedagogy—yes, pedagogy—for the turning out of finished pedagogues (and, by the way, it is worth while recalling that the Greek παιδαγωγος was, originally, not a teacher, but a slave who took the boys to school—a School Board officer of the olden time)—I say, even in these days of scientific education and of threatened pedagogics, it is wonderful how much we still rely on the good old rule of thumb.

We all, as teachers, assume that if we have a group of fifty pupils or so, say at ten years of age, we can very soon determine whether they are fit to be formed into one class. They are either clever, or commonplace, or duffers—what else can they be? Group them accordingly, and then we are ready to begin the year's work. Any teacher can do that who is worth his salt, not to mention his salary.

We all assume, do we not, that we know an average specimen of the pupil when we see one? But do we really? Think for a minute of those pupils of the age of ten. What is the normal height of boys and of girls respectively at that age? what is their average weight? what is their proper chest capacity? and what should their head measurement be? I, for one, have not the least idea of any of these quantities. But you may ask, Is it of any consequence to know such physical details?

Let us see. In school education, in all communion of mind with mind, as we saw, we have to depend on the physical. Sense-stimulus, involving nerve and brain action, is our only way to the pupil's mind. The condition of the

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brain, therefore, can hardly be a matter of indifference to the teacher. He may assume that it is normal unless he sees some evidence to the contrary, but the unfortunate thing is that most of us don't know where to look for such evidence, and don't recognise it when we see it. The size of the brain, at least, should be a matter of importance. But size, you may say, often counts for little or nothing. And size of body, height, weight, and chest measurement, you will perhaps conclude, can have nothing to do with school work.

Yet we must not dismiss it quite so hastily. If the body is below the proper measurements, there will probably be some reason for it, as there is for everything else. It may be want of nourishment. Well, if the body has been badly nourished, what of the brain? It has no private source of supply for itself; it must share in the general poverty: and surely a brain badly nourished is not fitted for doing our normal day's work in school. Again, there may be no want of nourishment, but a want of power somehow to make use of it. Now, all the organs of the body have their nerve-supply, either connected with or more independent of the brain. Feeble functioning by the organ is probably accompanied by feeble impulse from the nerves. So, after all, the want of mere size in the body may be an index of something important for us to know as teachers. It may be that small size is simply a matter of heredity, and that the body and brain are quite normal. If so, again we should know it.

The question of chest measurement is much more than a question of mere growth of bone and muscle. The size of the chest cavity is one of the factors that determine whether the blood gets a sufficient supply of oxygen. And on this supply of oxygen very much depends. The general health, of course; every one knows that. But very specially the energy of thought depends on the purity of the blood supplied to the brain; and not mere thought, as we call it, but feeling as well. And when we have said this, we have affirmed that chest measurement has something to do not only with mental qualities, but with moral qualities also. It is not among the hollow-chested that we expect to find our heroes and men of action.

Every teacher and school manager knows—School Boards know to their cost, perhaps—how many cubic feet of air should be provided for a child in our schools. Is it too much to add as a corollary that we should also know how many cubic inches of this air a child should be able to breathe in at each respiration; and further, to know, by our own measurement, whether this or that child can do so or not?

In certain schools, where expert medical assistance is provided for the guidance of the teachers in such matters, a regular exercise each day, especially in young classes, is that of *breathing drill*. The children are taught how to fill the lungs well, and they practise it together for a few minutes now and then. I can conceive of nothing more likely to invigorate a tired brain. There is no fatigue implied: you may regard it as a pause for refreshments—very light refreshments, no doubt, but quite as necessary as solid or liquid refreshments. I do not refer at present to its use in developing the breathing muscles and the lungs: that would be to go into the question of physical training. I merely point to its direct and immediate influence on our sole means of educating—the brain and the nerves.

The question of nourishment was mentioned a few minutes ago, in dealing with the pupil's growth. There we regarded it as an incident in the past history of the pupil. But it also comes in very powerfully as a factor in his present power of learning, whatever be his size or previous development. His *daily work* is dependent on his *daily bread* at present. By-and-by the conditions will perhaps be reversed.

The teachers in many of our city schools know better than I can tell them how want of food tells upon school work. It is a terrible confession for a civilised society to make, but it is only too true, that many pupils come to school insufficiently fed. How this is to be remedied is fortunately not a matter for this paper to consider; all that can be done here is to insist that, as teachers, we ought to *know* whether our pupils are normal in this respect before we ask them to do a normal day's work. This is one of the physical conditions that determine how far we can educate.

This question, as you may know, is one of the burning questions before the School Board for London. One party estimates the number of school children absolutely underfed in that city at 50,000; another party affirms that it is only 25,000. There is still greater divergence in the opinion as to the Board's duty in the way of remedy, and the matter is yet under consideration. But the mere statement of such facts shows how enormous an influence the question of food must have on the question of *possible school progress* in a large city. I do not refer here to its importance as regards the health of the pupil—that is too plain to require demonstration—I mention it only as one of the physical aspects of the pupil on which depends the possibility of educating him.

(To be continued.)

THE SCHOOL "BAND OF MERCY."

"Humans, be humane! it is your first duty. What wisdom is there for you apart from humanity?"—ROUSSEAU.

ABOUT six years ago, the Education Department gave its first official utterance in the direction of these words with reference to dumb animals, and now the School Board for London has passed an excellent resolution in furtherance of them. In response to repeated applications from Mr. Colam, the secretary to the Royal Society for the Prevention of Cruelty to Animals, who, we know, had approached successive Boards on the subject, lecturers, accredited by the society, are now to be allowed to address the Board's scholars, with the approval of the head teachers, after school hours in the afternoon. This is good as far as it goes; but we cannot help thinking that the London School Board will go further if the teachers generally express a desire for them to do so and will perhaps allow some of the Bible-lesson time, and also the recreation half-hour of Friday afternoons, to be utilised by the society's lecturers. Those of our readers who have already had the pleasure of a visit from one of the accredited gentlemen will know how great a treat, both educationally and ethically, he can give, and how fortunate the children are, as well as the dumb creatures, in this gifted advocate.

Some one, whose name for the moment we forget, has said that last century was the age of the rights of man, and the present of the rights of women. May we not as teachers, and therefore "in the know," declare unhesitatingly that the next will be that of the rights of children? But why should the third millennium dawn before it can be added, "and this for the rights of animals"? It is quite possible to work the last two together, and no one can more easily bring about the combination than the elementary teachers of our country. The children to-day need a new article of belief, and one about which none but the brutal will quarrel. It is this: Every sentient being has a right to as much happiness as possible because it is a sentient being.

And what is the Band of Mercy movement, and how can we introduce it into our schools to help our new creed along? A Band of Mercy is a child's institution, and owes its origin to Mrs. Smithies (mother of Mr. T. B. Smithies of *The British Workman*). More than a quarter of a century since, that estimable lady conceived the idea of associating children in little bands, as had already been done in Bands of Hope, to impress on them the claims of the animal world to their humane consideration. She went further; and before enrolling her members, obtained from them a signed pledge (similar to that which many had already given in respect of temperance) that they would do all in their power to render the lives of animals with which they came in contact happy, and would also endeavour to influence other children to do the same. And from the beginning the effort was a success, so much so, that when the lamented death of the lady led to the R.S.P.C.A. taking over her bands, they found in them another branch of juvenile work capable of great expansion. This the society immediately set to work to secure, and as

a preliminary step issued a little pamphlet giving all information respecting the formation of Bands of Mercy. This is still in use, and can be obtained gratis from Mr. Colam, at the office of the society, 105 Jermyn Street, St. James's, S.W. In case some reader would like to know at once what is involved by forming a band in school, it may be permitted here to say that a prospective leader would call a meeting of children, enlist their sympathies in the cause, and then enter the names of those who wish to become members on a roll, either of his own or in one obtained from Jermyn Street, after each child has taken the following pledge: "We agree to be kind to animals, and to do all in our power to protect them from cruelty and promote their humane treatment." The secretary will then be chosen, and a name given to the new band. The booklet referred to contains a list of all the bands in existence, so that no one need take a title already in use if he will take the trouble to look over that list. We have noted how few names of well-known humanitarians appear there. Considering that the greatest poets, as well as other great writers, have ever been humane, the wonder is that their names have not been more largely requisitioned. We do not think there is a single band named after Mrs. Smithies. Our own band is seventeen years old, and took its name from the school; but were we beginning again, and no one had forestalled us, Mrs. Smithies' honoured name would be our choice. But to return to the contents of the booklet, there are illustrations of the medals which may be worn by members, and only by members. These vary in price, according to their quality; but the penny one is the general favourite in elementary schools, and is in every respect but the metal as pretty as the more expensive ones. On one side are the arms of the empire, with suitable words; on the other is a group of the chief domestic animals. Children love to be told that the demure little puss who sits just by the horse's hind leg was pushed in there as an afterthought by the wish of the Queen, who is patron of the society, and to whom, as such, the medal was submitted when in proof. The gracious lady noted that the cat had been left out, and remarked the omission; very soon the artist made way for pussy, and there she is to this day. Besides telling of the medals, the book gives price-lists of all suitable humane literature, and lists of songs which may be sung at band meetings and elsewhere, and also explains how readers can secure the apparatus necessary to a good lantern lecture on various branches of the subject, and many other items of information.

We were about to say before we ran off at this tangent, for which the pretty little medal must apologise, that the new secretary of the new band would do well at once to send Mr. Colam word of what had been done, and ask to have the band affiliated to the society. Why, perhaps some one asks here, can we not do all this without joining the society? For this, among other reasons. If you belong to Jermyn Street, your little folks may wear the medal, which means a great deal to them, more than you can imagine till you have had some experience of the work. Also at Christmas you will be favoured with the opportunity of buying the most desirable children's literature at much less than cost price. There are other reasons, but perhaps these are the chief. Of course, all can please themselves; and the work can be done on private lines. We ourselves know a lady who, in her school, was working in the same way as Mrs. Smithies, quite unconscious that the idea had occurred to any one else. But she found it an immense advantage, when the movement came accidentally before her, to attach her work to the society's.

And now may a word be allowed as to the *detail of the work in school*. Most of us believe that the school syllabus is already too full, and that any straw, however light, may just be the one thing too much. May an old secretary say that it is quite astonishing how easily this subject works in with others? There are the Bible lesson on a specially-fixed day; the repetition from the best poets; the songs and hymns; the readers; the dictation and the composition lessons; the collection by the children of newspaper scraps on the subject, to be pasted in a disused exercise book, to be voted, when full, to one of their number; allowing in the Friday recreation time the bringing of pets to school, especially of those which have been poor little miserable strays till the young owners found them; photographs of these placed in the museum or on the walls; and a thousand and one other ways which naturally occur to every practical teacher. The pictures in a school where there is a Band of Mercy generally tell the tale. What can be better than "An Old Pensioner," by Rosa Bonheur, for young eyes to gaze on? If we remember that it is the spirit of the thing we wish to inculcate, we shall avoid too much of the letter, which is what makes all cram fatal. From experience one finds that it is not well to allow the two lower standards to attain to the dignity of members of the band. If two years are spent in preparation and in looking forward to the honour of membership, not only is the pledge a better understood thing, but an intelligent interest has been secured which is not likely to be evanescent.

There is no doubt that the animals will chiefly benefit by any efforts humanitarians may make in our schools, but the quality of mercy, the twice-blessed quality, takes on a threefold aspect when introduced to children in school life. The teachers have a pleasure quite unknown till they make this specific effort, and the children have a new and beautiful interest put into their lives, which every day can add to. And the sense of *camaraderie* resulting from union in a Band of Mercy often crops up at unexpected times and in far-away places. The following incident came before the present writer some time ago:—Two friendless girls, who found themselves in Canada by the good agency of Miss Rye, had been members of the same Board School Band of Mercy, but not at the same time. Each continued to wear her medal at her brooch. One day they passed each other in the streets of one of the Canadian towns; the eye of each was arrested by the other's medal, and they made a dead stop and asked where that little tell-tale had been obtained. "From my school," said the elder. "And so was mine," was the response. "And where was your school?" "Oh, in London." "And mine too." And so they proceeded, till they found that the same school had been common ground to them; and then how they began to talk of the old friends, of their school-fellows, and all that of which two lone young things could talk! Of course, each had to write home to her secretary to tell of the *rencontre*, and how in future they were going to be fast friends.

Nor is isolation felt only when our girls and boys reach the colonies. There are thousands of children in the schools of our great towns, and more especially in London, who feel themselves as much shut off from all good union, when school hours are over, as if they were in a desert. Whatever tends to lessen this must be civilising and ennobling. We differ about feeding them with what the hymn terms "the bread of life," and we differ also with respect to feeding them with daily bread, but no one yet has been heard to oppose the teaching of humanity. All seem at least to agree with Ruskin in this one thing, that "without perfect sympathy with the animals around them, no gentleman's education, no Christian education, could be of any possible use." There is indeed a perfect wealth of great men's utterances on this subject, if more authority be needed; for whatever differences divide intellect, there is in the minds that have the most lasting influence over mankind the greatest unanimity in this.

We shall not be far away from the topstone of our educational system when from their hearts our boys and girls, and our young people in the evening continuation schools, shall say:—

> "Among the noblest in the land,
> Though he may count himself the least,
> That man I honour and revere
> Who, without favour, without fear,
> In the great city dares to stand
> The friend of every friendless beast."

In conclusion, shall we offer an apology for thus seriously dwelling on our subject? If so, we would like to say that the condition of the cruelest countries in Europe—Greece, Italy, and Spain—to any of which a visit is robbed of half its pleasure by the cruelty witnessed to our dumb fellow-creatures, must be part of it; and for another part we would like to instance the recent introduction of the bull-fight to

France. This is coming next door, and whatever befalls French morality soon finds echo with some classes here. The remaining part of the apology we will give in the following words, taken from that excellent lesson-book by Mrs. Charles Bray, entitled, *Our Duty to Animals*:—

"Not long ago the society [R.S.P.C.A.] heard that some Spaniards were going to have a bull-fight at a hall in Islington. Now at these bull-fights it is the custom to rouse the bull to fury by throwing darts at him.....Well, a great crowd went to the hall to see the fight.....Four bulls were led out to the fight, and one of them had his side pierced with an arrow. In a moment, Mr. Colam, the secretary of the society, rushed into the ring, seized the dart, and told the Spaniards that the fight must not go on. At this the Spaniards yelled at him, and the mob of thousands shouted at him, and Mr. Colam had to fight his own way back from among the savage crowd. But he carried off the sharp dart, and showed it to the magistrate as evidence of cruelty to the bulls; and the Spaniards were fined for bringing such disgusting and degrading sport to England."

And Islington is in London.

(*To be continued.*)

MR. MACKINDER ON THE ECONOMIC POSSIBILITIES OF AFRICA.

THE globe is made up of ocean and islands. The geography books divide it up into oceans, continents, and islands, and define the latter as things surrounded by water. But the ocean is one and continuous, and all the land is surrounded by water. This explains the basis on which the British Empire is built. If we must speak of continents, there are really only two —America and the Old World. Europe is but a western peninsula of Asia, and Africa a south-western.

The ancient world was centred round the Mediterranean. At the present day two-thirds of the population of the world are gathered in Europe, India, China proper, and Japan. There are 300 millions in Europe, and 700 in the second area. Each area contains from three to four million square miles. Now the total population of the world amounts, roughly, to 1,500 millions, and the whole land surface equals fifty million square miles. Hence one-sixth of the land surface ($= \frac{1}{3}$ of the whole globe surface) contains two-thirds of the population of the world. Of the rest, fully 100 millions live in North America, 200 millions in Africa south of the Sahara, and 100 odd millions in the rest of Asia. So we see that the population of the world is mainly in the northern hemisphere. But in the southern hemisphere there are three great peninsulas (if we regard Australia as a continuation of Asia), containing twenty-two million square miles, and with not more than 300 million inhabitants—and perhaps not much more than 200 millions. Thus we have nearly half the land surface of the globe containing only one-fifth or one-sixth of the total population. The problem to inquire into is the economic value of these lands, which we can regard as (1) actual, or (2) potential. That is, it can be measured by their consumption of Manchester goods, and their export of manilla, vanilla, indiarubber, etc.; or, potentially, in the light of the population they can support. Now the first measure is a fluctuating one. Industry is getting distributed. The mills in India are seriously menacing the Lancashire cotton trade. South American iron is competing with Spanish. The Indian trade in Natal is ousting the European. The *régime* of the centralisation of industry is passing away. To take, therefore, the second measurement—what population can these continents (or Africa, to confine ourselves to the subject)—support, we must study the physical character of Africa in order to arrive at an estimate of its economic life.

Africa lies astride of the equator, between latitude 35° south and latitude 37° north. The result is a bi-symmetry. The rainfall proves this. Rain is the one thing essential to fertility in Africa. Water makes for fertility. There are distinct zones of rainfall. From north-east and south-west the trade-winds blow from year's end to year's end, and from century to century. Between them lies a zone. Behind them lies to the north, in Europe as a rule, the west wind, and to the south a ceaseless west wind, which blows for ever round the world. So strong is this wind that when steamers go out to Australia by the Cape route, they refuse to face the gale coming home, and return by Cape Horn. In Europe, owing to the land, the west wind, though prevalent, is not so strong as the "roaring forties."

We have thus five zones—at the centre the torrid, which is rainy, flanked on either side by the trade-wind zones, which are practically dry, and behind these the zones occupied by the west wind. With the seasonal swing, due to the earth's movement, the whole system moves northward during our summer, and goes south in winter. The rain follows the sun. Therefore during our summer there is rain right across the Sudan; hence the monsoon in Abyssinia and the rise of the Nile. The trade-wind retreats to the Sahara and the shores of the Mediterranean; hence a rainless time along the littoral, so that in Morocco the crops do not grow during the summer, which is dry, but during the winter, which is wet. The Sahara is always dry, being always covered by the advance or rear guard of the trades. The Sudan is moist in summer, and dry in the winter, when the trades come back. The heat of the summer is modified by the clouds. The harvest is in the autumn, as the growing time is during the summer rains. In the centre is the rainy belt. In Guinea, for instance, there are rains and warmth all the year round. South of the line you have similar zones. North Rhodesia corresponds to the Sudan, and Cape Colony to Morocco.

But these zones do not extend completely across Africa. Why? 1. The north-east corner is affected by the proximity of Euro-Asia and the deserts of Arabia. 2. From Suez to the Cape runs the great elevation of the African table-land. This has little effect in the north; in the south, however, the elevated land benefits from the moisture the trade-winds bring. Hence the Natalian desert is far smaller than the Sudan. Africa is really a great table-land. In 300 miles the Uganda Railway rises 6,000 feet. Victoria Nyanza lies at an elevation of 4,000 feet. All the rivers are broken by cataracts (Niger, Nile, Zambesi, Congo). On the Nile they are far inland, on the Congo near the coast. The supply of moisture along the highest part of this backbone is small. All great productive regions of the world are low lands. Western Siberia is a low land, so are also Northern India, China, and the Mississippi valley.

Rainfall, therefore, is the first economic consideration. The Congo district seems at first sight the most productive. But its present value is relatively low. Still, it only requires a great discovery in medical science for the white man to live and work under the conditions of the Congo. Such a discovery would be equivalent to Columbus's discovery of the New World. It would multiply many times the power of the world's supply of food. At present the best regions to cultivate are those visited by the monsoon—that is, right across the Sudan and the corresponding district in the southern portion, as well as along the elevated backbone. As regards British East Africa and British Central Africa, the irregularity of the rainfall is the chief drawback. Last year there was a great drought all along the Uganda railway; in 1892 the rain fell every day.

It is worth noting that the population of South Africa is five times as great as that of South America, while the production of South America is four or five times as great as that of Africa. The Congo State and the Western Sudan are the most densely populated. The Haussas are a great trading community, inhabiting cities of 100,000 inhabitants. North of the Sudan is steppe-land, good for corn and cavalry. In British Central Africa the land is so thickly cultivated that during Mr. Mackinder's recent expedition, time after time the only vacant spot his company could find to encamp on was the market-place of a town or village they came to. As for Rhodesia, everything depends on the mines. A large mining population will encourage agriculture. We think too much of mere commodities, and are apt to underestimate the riches that proper cultivation can draw from the soil. Vegetation is quite as great a power as manufacture. In Africa, the Sudan and East Africa will be the first to be developed. The external trade may not be great at the first. It will be our function to control the country for the benefit of the inhabitants. Later on there may be a big trade in tools and implements. But the principal trade will rather be internal. This, however, may afford opportunities for the investment of white men's capital. The retail trade is already in the hand of the Indians. East Africa is rapidly becoming an appanage of India.

THE WAR FUND.—Messrs. Moffatt and Paige, Limited, have hit upon a happy idea for raising contributions by promising to pay to *The Daily Mail* War Relief Fund the sum of one shilling for every gross sold of their NEW KHAKI EXERCISE BOOK. The book, which consists of forty-eight pages, is ruled "ordinary" on superfine foolscap, and bears on its khaki-coloured wrapper a reproduction of Caton Woodville's drawing, "A Gentleman in Khaki," and Kipling's poem, "The Absent-Minded Beggar." Nine shillings per gross is the offer to schools.

Our Monthly Retrospect

EDUCATION IN ENGLAND.

N.U.T. NOTES, ETC.

BY T. B. ELLERY, F.R.G.S.,

President of the National Union of Teachers, 1895-96.

The Vice-Presidency of the N.U.T. THE election season is once again with us, and the members of the Union who take a practical interest in such matters will shortly be able to record their votes for the ladies and gentlemen who are candidates for the thirty-six seats upon the Executive, and for one of the five gentlemen who aspire to the chair. The five are: Mr. J. F. Blacker, Christ Church School, Brighton; Mr. H. Coward, Board School, Anglesea Place, Bristol; Mr. A. Croft, Board School, Bath Street, Nottingham; Mr. T. John, Llwynypia Schools, Rhondda; and Mr. F. Peaker, 18 Linden Road, Leeds. They are all able men, good men and true; but as only one can be elected, members will have the difficult task of deciding how they shall cast their vote upon this occasion. In point of service Mr. Tom John is the oldest member of the Executive who has not passed the chair, and this fact will undoubtedly count for something with many. If, however, nominations are an index to Union feeling, Mr. Blacker's election is sure. He is the chairman of the Parliamentary Committee, in which capacity he has proved himself a thoroughly capable man. Mr. Harry Coward has rendered excellent service in many ways, and especially as vice-chairman of the Superannuation Committee, and as chairman of the Benevolent Central Committee. Mr. Allen Croft has had good experience as vice-chairman of the Education Committee, his valuable work receiving the unanimous approval of his colleagues at Russell Square. Mr. Tom John has laboured for thirteen years at Fleet Street and at Russell Square, his special "departments" being Welsh education and the Organisation and Parliamentary Committees of the Union. Mr. Fred. Peaker has proved himself a most efficient chairman of the Finance Committee, working with a zeal, energy, and discretion deserving the highest praise. These are the men who are soliciting the votes of the great army of Unionists, and it can be said of them all—they deserve all the good fortune that may come to them.

The Executive Election. Once more the Union's honorary treasurer, Mr. G. M. E. Hamilton, F.E.I.S., is elected without a contest. Well does he deserve the honour, and long may he live to enjoy it. For the thirty-six seats on the Executive there are *sixty-nine* candidates; a fairly good indication of the greater interest being taken in the election. In one division only—unless certain candidates withdraw—will there be an unopposed return of the existing members, and that is in District No. 11, where Messrs. Blackburn, Hole, and Hurden will be spared any anxiety as to their success.

In *District No. 1* there are six candidates—Messrs. Bowden (London), Donkin (South Shields), Hindmarsh (Durham), Hughes (Newcastle-on-Tyne), Phillips (Maryport), Turner (Sunderland).

District No. 2 (4)—Messrs. Holden (Manchester), Pickles (Burnley), Roberts (Rochdale), Sharples (Manchester).

District No. 3 (5)—Miss Cleghorn (Sheffield), Messrs. Jones (Huddersfield), Moorby (Hull), Peaker (Leeds), Sykes (Bradford).

District No. 4 (6)—Mr. Baddeley (Burslem), Dr. G. Beach (Macclesfield), Mr. A. Croft (Nottingham), Mr. Lewis (Langworth, Lincoln), Miss Selvage (Hainton, Lincoln), Mr. Smith (Retford).

District No. 5 (6)—Messrs. Boulter (Leicester), Cohen (Birmingham), Flavell (Birmingham), Dr. Macnamara (London), Mr. Muscott (Garsington, Oxford).

District No. 6 (6)—Mr. Baldwin (Bedford), Miss Broome (Ipswich), Messrs. Ellery (Luton), Gale (East Dereham), Horobin (Cambridge), Lenton (Peterborough).

District No. 7 (8)—Messrs. Apps (Chichester), Blacker (Brighton), Caudle (Reading), Clarke (Strood, Rochester), Miss Goodwin (Southampton), Messrs. Gudgin (Croydon), Holdaway (Chichester), Sandford (Alverstoke, Gosport).

District No. 8 (5)—Messrs. Butland (Newton Abbot), Coward (Bristol), Gregory (Castle Cary), Williams (Swindon), Winfield (West Town, Bristol).

District No. 9 (9)—Messrs. Brockington (Cardiff), Jenkins (Swansea), T. John (Llwynypia), Lewis (Llanddarog, Carmarthen), Tegarty (Glasinfryn, Bangor), Thomas (Maentwrog), Tilby (Rhyl), Miss Williams (Cardiff), Mr. Willmott (Cardiff).

District No. 10 (6)—Messrs. Cullum (St. Luke's, E.C.), Johnson (Ealing Dean, W.), Jones (Hornsey Rise, N.), Kelly (Kentish Town, N.W.), Munks (Acton, W.), Thompson (Notting Hill, W.).

District No. 11 (3)—Already dealt with.

District No. 12 (5)—Mr. Bowers (Woolwich), Miss Lane (New Cross), Messrs. Nicholls (Plumstead), Oliver (Peckham), Phillips (Bermondsey).

Superannuation: Disablement Allowances. Many members of the Union have feared that hard and fast rules would be observed by the Education Department with respect to the granting of disablement allowances under the Superannuation Act of 1898, and it is quite true that certain applications have been refused. But in every case where the medical officer has testified to permanent breakdown the allowance has been granted. In one case, for example, in which the writer of these Notes interested himself, the application had been refused, though a medical certificate had been sent to the Department; but certain steps were taken, satisfactory medical evidence was forthcoming, and in the end the lady concerned was successful. Similar cases might be quoted but for considerations of space. One of the latest is that of a teacher in the west, who, though unsuccessful at first, has now obtained (in great measure through the efforts of Mr. H. Coward of Bristol) a disablement allowance of £44 per annum.

The great thing in all such cases is for members to place themselves in the hands of the Union's officials, who will give the necessary advice as to the proper steps to be taken. Rules must, of course, be kept, and the Department is perfectly justified in stating that all the conditions laid down by the Act must be observed.

Something for the "Old Guard." The question of "recorded service" has agitated many minds for some time past. A large number of the "Old Guard" worked, in their early days, in schools which did not receive a Government grant, or which were not under inspection. It has been understood that none of the years of service rendered under such conditions could be reckoned as "recorded service." Even now nothing definite can be said on the point, but it is interesting to note that at least one teacher's "time spent in —— National School whilst a certificated teacher, although no grants were paid to the school by the Department, and although, it is believed, the school was not even under Government inspection," has been admitted to be "recorded service." In this particular case the Department has just informed the teacher that his service will count from 6th March 1853. He has, therefore, forty-six years to his credit, and he will draw what may perhaps be termed a respectable pension allowance.

The "Old Guard" should make a note of this. If "My Lords" will but take this view generally, there will not be so much heartburning and so much dissatisfaction as one finds on all hands at the present moment. The Executive of the Union, anxious to do the best possible for these old

servants of the state, has agreed to ask the Department to receive a deputation on the subject of these pensions. This deputation—if the arrangements are made—will argue that, Government grant or no Government grant, inspection or no inspection, every year of service in an elementary school should count as "recorded service." This demand is, it is said, not sufficient to satisfy certain of the "Old Guard." These gentlemen, however, should remember that there are tremendous difficulties in the way, which it is not necessary to name in these columns. Nor is it desirable that they should be named. *A word of warning may not be out of place.*

The teacher to whom reference has been made in this "Note" writes:—"I beg you will convey to the Executive my appreciation of the work being done by them for the 'Old Guard.'"

The Tenure Question. Over and over again it has been said in these columns that, with superannuation an accomplished fact, the question of reasonable security of tenure was one that demanded immediate attention. Is a teacher to be compelled to pay £3 to the Government Superannuation Scheme, only to find, after ten or twenty years, he is dismissed from his post, with no reasonable cause assigned, by the "one man manager," or a small, pettifogging School Board? Does the average ratepayer know that such a state of things is possible? If not, it is quite time he was told. At every meeting of the Union's Tenure Committee new cases crop up of able teachers being dismissed, not because they have failed in their work, not because their characters will not bear the closest investigation, but because the "one man manager" *desires a change*, or because the small Board can save a five-pound note—or thinks it can—by a change of staff. One clerical gentleman, on beginning work in a new parish, openly admitted he wanted a change because it was easier to mould a new man into his ways than it would be to mould one who had been in the parish a number of years! Is this sort of thing to be permitted to go on? Is a man after ten, twenty, thirty, or forty years' service to be at the mercy of men of this type—men who have no feeling, no sympathy, no soul?

Owing in great measure to the exertions of the Union, the teacher's position, speaking generally, is stronger than it was some years ago, but no one is safe while it is possible for managers to dismiss without reasonable and assigned cause. The Union's demand is a sound one. There is nothing unreasonable about it; no one asks for *fixity* of tenure.

Tenure: The Alleyn's School Difficulty. Has the head-master of Alleyn's School, Dulwich, *fixity of tenure?* If so, he can do as he pleases, and appoint and dismiss assistant masters at his own sweet will. Surely the revelations in the "Organ" will lead to some reform in the management of this important school.

It is believed that the governors, though they cannot prevent the head-master from dismissing assistant masters whenever he thinks fit, can step in and say they are not satisfied with the present position of affairs, and ask the principal for an explanation. This may or may not be the case; but if the governors have this power, they owe it to themselves, and they owe it to the staff and the school generally, to interfere. It is simply monstrous that assistant masters should be dismissed for the reasons given. Fortunately, most if not all of those concerned are members of the Union – a fact which, though it will not save them from the consequences, such as they are, of the head-master's wrath, will be quite sufficient to save them from financial and professional ruin. Teachers in secondary schools will see from this that the Union is a sure rock for them, as well as for their colleagues working in elementary schools.

Another Tenure Case. Members of the Executive are popularly believed to have a very happy time, with little or no work to do. Those who are intimately associated with the tenure work of the Union could paint a very different sort of picture. From the nature of things, details are not published when a compromise is effected and the notice of dismissal is withdrawn. If these details were published, fresh difficulties would arise with the Board or body of managers concerned, and therefore a discreet silence is observed. In the settlement of these tenure problems members of the Executive play a very active part, though the fact is not known outside the Executive Board and the town or village in which the affair takes place. As an instance of what is being done weekly, the following may not be without interest:—A teacher, over fifty years of age, and with a very large family, receives notice of dismissal. He fears it is hopeless to attempt to induce the Board to alter its decision, but he places himself in the hands of the Union. A member of the Executive, who has had considerable experience in these matters, is sent, *during the Christmas holidays*, to the district, to do his best for the unfortunate teacher. At such a time the home attractions are great, the journey is a long one, the weather by no means inviting; but at the call of duty the member sets out upon his errand of mercy. He spends two days in the locality, interviewing right and left, and using all the means at his command to effect a satisfactory settlement. With all his work, the best he is able to do is to obtain permission to attend the Board meeting in the following week. He returns home, then journeys to London, where he confers with the officers of the Tenure Committee: and a day or two afterwards sets out on his long railway ride, with several miles of road at the other end. He interviews the Board, addresses the members for three-quarters of an hour, and then leaves the issue in their hands, but with a certain amount of fear and trembling. After another hour he is again called into the Board room, and informed that the suggestions made by the Union's representative would be adopted, and the notice of dismissal would be withdrawn. The chairman, in conveying the decision of the Board, complimented the member upon the "ability and moderation" with which he had stated the teacher's case. The look in the teacher's face when the decision was made known, his expressions of gratitude, together with the tearful thanks of the good wife, were ample reward for a broken holiday and for several anxious days and nights.

This is a type of tenure case of which the Union hears little or nothing, and it shows what the committee is able to do when the teacher himself is loyal to the instructions he receives.

A Seat on the Executive for the Editor of the "Organ." The Executive, at its last meeting on 6th January, debated at some length the question of a permanent seat at Russell Square for the editor of *The Schoolmaster*. At present Dr. Macnamara sits for the South Midland District, in company with Mr. Rankilor and Mr. Cohen. From what was said in the course of the debate, it appears that some good people in the South Midland District are of opinion that the Doctor should sit for a London division, and thus allow them to have another local representative. This, of course, is no reflection upon the worthy editor, whose splendid work for the Union would secure for him a victory in any of the twelve divisions in which he allowed his name to go forward. That goes without saying. It is, however, felt by many that it would not be wise for the Doctor to sit for a London division, having regard to his public work—on the London School Board and elsewhere. It is quite clear that he *must* have a seat at Russell Square; he is an indispensable part of Union organisation and Union life. It has occurred, therefore, to a number of good people to create another seat, and give it to him so long as he holds office as the editor of the "Organ." Probably Conference may be induced to agree to this suggestion, for the 1896-97 president deserves every honour the Union can confer upon him. Whether, however, this particular step is a sound constitutional procedure is open to grave doubt. The Executive, towards the close of its meeting on 6th January, agreed, by a small majority, to the principle. By the way, readers of THE PRACTICAL TEACHER will be sorry to learn that Dr. Macnamara has had an attack of influenza, and was unable to join his colleagues at the first meeting at Russell Square in 1900.

The Work of the Benevolent Fund. Mr. Chase is an excellent chairman of the Relief and Loans Committee of the Orphan and Benevolent Funds. At the last meeting of the council he brought up a report which must have cost him

hours of thought and labour. From that report it can be seen that there were—

17	applications	for	temporary relief.
9	,,	,,	loans.
14	,,	,,	admission to the Homes.
39	,,	,,	home allowances.

Owing to the present position of the funds, some of these people, both young and old, had to be sent empty away. Readers of THE PRACTICAL TEACHER, will you not assist in this good work? At present the Benevolent Fund's responsibilities in the way of annuities alone are as follows:—

26 men at £30	£780
50 women at £25	1250
1 woman at £20	20
2 widows' annuities at £15	30
1 woman at £5	5
Total (annually)	£2085

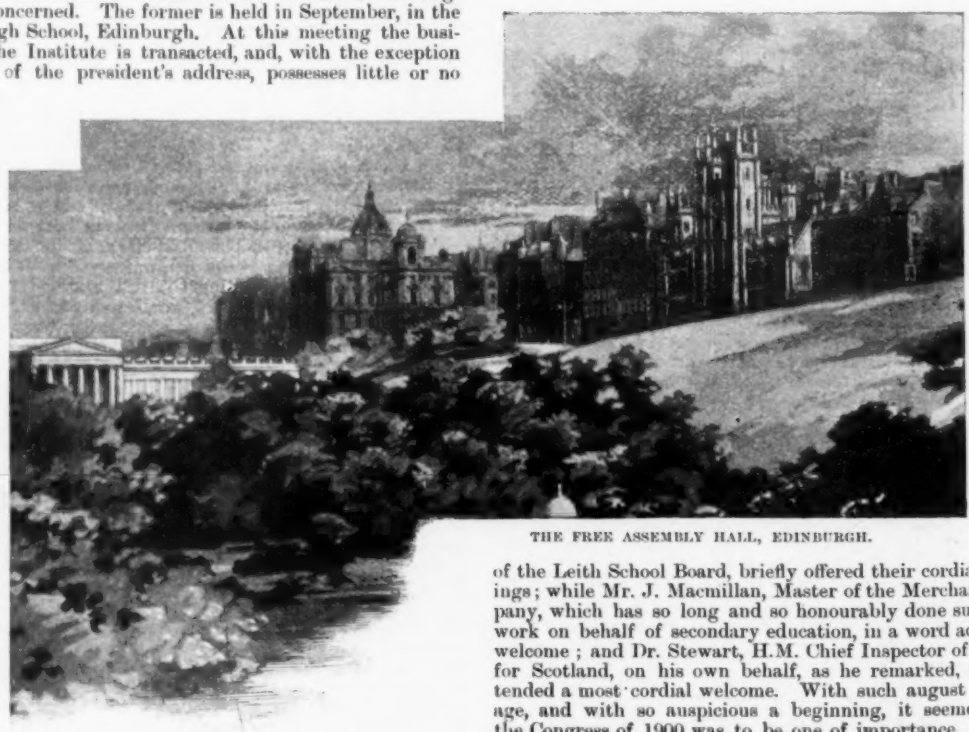
THE EDUCATIONAL INSTITUTE OF SCOTLAND CONGRESS.

BY OUR OWN CORRESPONDENT.

As most of the readers of this journal are aware, the Educational Institute of Scotland has two great meetings in the year—one fixed and the other movable so far as meeting-place is concerned. The former is held in September, in the Royal High School, Edinburgh. At this meeting the business of the Institute is transacted, and, with the exception probably of the president's address, possesses little or no interest to the general public. The "movable feast of oratory" usually takes place in the centre of the district from which the president for the time being has been chosen. This year, however, a departure from the ordinary practice was made, inasmuch as Edinburgh, though not the home of the president, was selected as the place of meeting of the Twenty-sixth Annual Congress. This choice was wholly due to the fact that the Scottish Educational Exhibit, from which the final selection of exhibits for the Paris Exhibition was to be made, was on view in Edinburgh during Christmas and New-Year weeks. It was accordingly thought that it would be a good thing if members attending Congress could "do" both.

The success from the point of numbers of a congress at this time of the year is largely dependent on the climatic conditions. The boisterous and wet character of the opening day (January 3) was largely responsible for the somewhat meagre audience that rose to welcome the entrance of the president (Mr. W. S. Blackstock, Kirkcaldy), who was accompanied by Sir James Russell, Professor S. S. Laurie, Mr. C. G. Macrae, Mr. R. H. Miller, Mr. J. Macmillan, and Dr. Stewart. On the rather crowded though representative platform we noted Miss F. C. Stevenson and Mrs. Kerr, members of the Edinburgh School Board; Dr. J. Gunn, M.A., chairman of the Edinburgh Branch; Dr. Dunn, H.M.I.S.; Dr. Mackay, treasurer of E.I.S.; Mr. John Laurence, secretary; Messrs. G. Sharples and Tom John, delegates from N.U.T.; R. Brown and P. Ward, from I.N.T.O.; Dr. J. E. Parrott, M.A. ("the Silent Member"), and Mr. S. M. Murray.

The first part of the proceedings, as usual, took the form of a reception by patrons. Sir James Russell, on behalf of the city and Corporation, extended a most hearty welcome to the Congress, and in so doing expressed the hope that it would prove both interesting and instructive. Professor Laurie in a few words welcomed the Congress in name of the Senatus of the University, acknowledging that the teachers of Scotland contributed no little part to the success of that body. Mr. Colin G. Macrae, W.S., Chairman of the Edinburgh School Board, and Mr. R. H. Miller, S.S.C., Chairman



THE FREE ASSEMBLY HALL, EDINBURGH.

of the Leith School Board, briefly offered their cordial greetings; while Mr. J. Macmillan, Master of the Merchant Company, which has so long and so honourably done such good work on behalf of secondary education, in a word added his welcome; and Dr. Stewart, H.M. Chief Inspector of Schools for Scotland, on his own behalf, as he remarked, also extended a most cordial welcome. With such august patronage, and with so auspicious a beginning, it seemed as if the Congress of 1900 was to be one of importance. On the motion of Colonel W. U. Martin, an ex-president of the Institute, cordial thanks were voted to the patrons for their presence and words.

The president then delivered his opening address, on the subject of

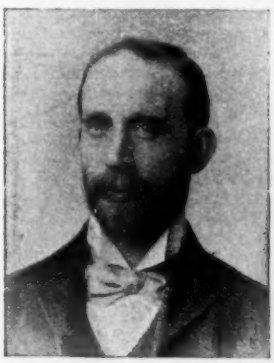
Certain Aspects of School Life in Scotland.

Greater educational progress had been made, he thought, in Scotland during the last two decades than during the previous two centuries. In the old parish school the ordinary subjects of school work had not been linked on to the

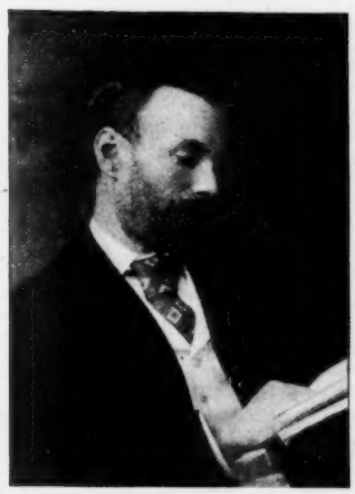
after-life of the pupil. But new conditions had arisen, and under the latest Code our educational authorities had risen to their country's need. He had no sympathy with those who decried the earlier Codes. Something was needed to bring the ordinary school subjects well within the reach of the school children of Scotland. These Codes were but stepping-stones to higher things, and they impressed upon our Scottish system the principle that, while instruction might be given and minds built up in the mass, no school method could be perfect which was not based to a considerable extent on attention to the individual.

The child of the state had other duties than that of earning his daily bread, though that might be the main purpose of his life. He had points of contact with his social environment; he had duties to face as a component part of a great empire. The perfection of the unit, however, was the sure means of securing the perfection of the whole. Instruction and brain-development secured in school required to be linked on to the future work of the child. The school objective was to acquire strength of limb, keenness of intellect, and uprightness of character. Nevertheless there was room for specialisation in the upper forms of our common schools, so that the pupil might either be passed on to the secondary school, or, so far as possible, trained for his special work in life.

R. G. Dickson, M.A., F.E.I.S.,
Secretary.



J. Paterson,
Member of General Committee,
E.I.S.



J. Gunn, M.A., D Sc,
President.

The subjects of a common school curriculum fell under three heads:—(1) Necessary subjects; (2) Social subjects; and (3) National subjects. To the non-differentiation of of these he attributed much of the failure in results.

From his eminent position in the world of botany, the president in no unstinted measure advocated

The Claims of Nature Teaching.

Nature teaching was one of the greatest forward movements in education of the last twenty years. This teaching was not merely a question of shimmering seas, of verdant leaves and snowy clouds. It was not a mere statement of hard, dry fact; for the æsthetic side of a child's nature was undoubtedly developed by even the scrappiest acquaintance with nature. Nature teaching must be the broadest of all school subjects, because it had points of touch with every other; it formed a medium for developing the child's physical capacity.

Before closing, he referred, as convener of the Superannuation Committee, to that important subject. He thought the present allowance too small. It was not a recompense for deprivation of certificate and of power to labour.

The work of the common school was wide enough. It was attracting more and more public attention. He asked teachers to do their work quietly, without stint, and well, and, as a result, public recognition and gratitude would be theirs.

Dr. Mackay, in moving that the best thanks of Congress be accorded to Mr. Blackstock for his admirable paper, referred to the unwritten law that presidents' utterances at these Congresses should not be criticised.

Miss F. C. Stevenson, who next addressed the Congress, is well known for the wide and deep interest she has always taken in matters educational, and in Edinburgh in particular for her unsparing efforts on behalf of the children attending our Board schools, she having been a member of the metropolitan Board for nearly twenty-eight years. Her subject was

Board School Education,

and she discussed the question as to whether the legislation of 1872 had been justified by results.

Her paper she divided into two parts: (1) What had been expected from our Board School education; and (2) What might reasonably be expected from it in the future.

In speaking of the expectations, she did not consider them from the point of view of the theoretical educationist, nor of the school teacher and school manager, nor yet did she seek to speak of results which could be measured by statistics showing the material educational advance made in increased and improved school accommodation and attendance, and very largely increased expenditure of public money. The expectations she referred to were those of a critical and not always sympathetic outside public, whose criticisms were not always founded on knowledge. With education put under popular control and made compulsory, it was expected that our whole social condition would be raised and purified, that the Board school would be a light dispelling illiteracy in the remotest corners of the country, and that before the flowing tide of knowledge all ignorance and vice and lawlessness would be swept away.

W. D. Elder, F.E.I.S.,
Treasurer.

More than a quarter of a century had passed since 1872, and in spite of School Boards, and Board Schools, and compulsory and free education, there were still children in remote country districts, as well as in our towns and cities, who had escaped through the too wide meshes of the educa-

tion net. And there was still work for the philanthropist to do, in protecting children from the cruelty of their parents, and in rescuing them from the poverty and vice by which many of them were surrounded.

She did not think that the expectations raised were reasonable, nor the strictures passed on Board School education just. A mere change of educational administration, however popular or enlightened, could not reasonably be expected to produce a moral revolution. Human nature was much the same now as then, and there did not seem to be much difference in the material character of the children. She unhesitatingly affirmed that Board School education had exerted an enormous influence for good on the generation of children who had had the full advantage of what it offered. But no system of school training, and no educational advantages, could ever wholly counteract the influence of a bad home. School training could only have the highest results when it had a foundation of good home training to support it. It was idle to expect that the five hours of the good condition of a child's school day could ever counterbalance the bad condition under which the other nineteen were spent.

In the statements made with regard to the failure of Board School education, as in other things in life, it was the voice of the non-contents, and not of the contents, which was most readily heard.

With regard to

The Future of our Board School Education,

she believed that never before had school managers and school teachers better opportunity of raising the standard of education in our national schools. If that education had in the past failed to effect all that was expected of it, there had been nothing to discourage us. Experience had thrown light on the path before us, and by the light of that experience the faults of the older methods would give way to the more enlightened provisions of the new Code, if these provisions were not, indeed, the results of these faults.

After some very interesting remarks bearing out the main contentions of the paper, by Dr. Dunn, H.M.I.S., the Congress, through Dr. Gunn, very cordially thanked Miss Stevenson for her interesting and valuable paper. With this the forenoon sederunt was brought to a close.

Afternoon Sederunt.

After the interval the audience was somewhat slow in gathering, so that when the president took the chair there was only a fair attendance. To Councillor J. Harrison, Chairman of the Edinburgh Chamber of Commerce, was entrusted the important and pressing subject of

Commercial Education.

He did not know, he said, exactly what commercial education meant, although he had sat for some years through the meetings of the Associated Chambers of Commerce, and had heard many discussions as to the necessity for its improvement; the exact article, indeed, which was to be improved he had never been quite able to define. He fancied one knew what the word "commercial" meant, and we were all quite sure that our very own definition of "education" was truly comprehensive, but the "chemical affinity" between the two words, when brought together, was a problem he shrank from tackling.

He confessed he was unable to believe that teachers could educate in commerce at all. While bearing willing testimony to the deep debt of gratitude Scotland owed to the old dominies, he did not think they tried to give a commercial education, and yet the boys they taught went out over the world as merchants, and when they came home, bearing their sheaves with them, they ascribed their success in no small measure to the education they had received in the old school-houses. But neither now nor then could schoolmasters give an education in commerce, so far as he could see. If the boys committed to our care had given them a fair chance of becoming men, they might surely make merchants of themselves. He had, he said, read much literature on "commercial education," and heard a good many debates regarding it; but very many of the appeals for improved "commercial" education were only wails over the backward condition of secondary education, or plaintive cries against the inflexible despotism with which the classics were forced on those who did not wish for such teaching. He deprecated a classical education for business men.

After stating where the claim for so-called commercial education could be found most fully and distinctly stated, he proceeded briefly to state his own opinions regarding the school training of business men. With regard to elementary education, he believed all business men were unanimous in desiring that there should be no specialising, and no attempt made to separate the education of children destined for business from other children. Probably most business men would desire fewer subjects taught. After showing what subjects he desired to be taught, he said there was a great necessity for the development of the modern side of schools, so as to put the modern on an equality with the classical. He did not think modern languages were well taught in most schools, and there was absolute demand for these on the part of the mercantile community. He would recommend the consideration of this question to the members of the Institute, as it seemed to him the most difficult problem in the education of both boys and girls intended for mercantile pursuits.

It was not the duty of the teacher to teach a boy his trade, nor should the boy begin in school his office apprenticeship.

Those who advocated improved commercial education did not ask teachers to change the object for which children are taught, but only to alter the medium by which education is imparted. Men engaged in business live in a very modern world, and work with new instruments—steamships, railways, electric telegraphs; and they believed that education must be altered to suit altered conditions, and that new methods must be adopted to bring about the old objects of education.

On the motion of Mr. J. G. Thomson, ex-President, who has in the Institute always taken a deep interest in this subject, a vote of thanks was accorded to Councillor Harrison for his well-reasoned, practical, and useful paper.

The President then called on the Chairman of the Edinburgh School Board, Mr. C. G. Macrae, to give the next paper, on

The Supply and Training of Pupil Teachers.

That the quality of education depended more than anything else on the quality of the teacher, appeared to him to be a self-evident proposition. It was, therefore, a question of serious moment whether the teacher was himself properly trained and fitted for his high functions. Heaven-born teachers were scarce, and he had more confidence in the terrestrial process of evolution. The mere fact of a person having received a good general education was no guarantee of fitness for the teaching profession, and special preparation of a professional nature was necessary.

The interval between the time of leaving the elementary school and entering the training college was all-important in the life of the future teacher. He noted that the supply of male teachers had for some years been falling off to such an extent that fears were entertained that the species might become extinct at no distant date. The scarcity was due to the pupil-teacher system.

The restraint of school life was irksome to the great majority of boys, and they longed to be free. Besides, there was the potent fact that boys of fifteen or sixteen might, in all town districts, find employment for their time to greater pecuniary advantage; and they were not so far-seeing, he thought, as to think more of the future than the present. (It may be that they are too much *for*seeing.)

The remedy lay in removing the drawbacks to the profession. Higher pay, and an increased number of prizes in the shape of preferment, would certainly improve the flow; but something could also be done by a reduction of the period of apprenticeship and the expense of training, and, most of all, by an alleviation of the labours that harassed the pupil teacher's life, by an increase of the allowance of time for his private studies, and by securing for him qualified instruction by persons specially fitted and selected for this duty, and, finally, by raising the standard of proficiency so soon as this can be done without risk of over-pressure.

1. S. M. Murray, F.E.I.S. (General Committee).
2. W. U. Martin, F.E.I.S. (Press).
3. A. J. Johnston, F.E.I.S. (Assembly).
4. Miss C. Cameron, F.E.I.S. (General Committee, E.I.S.).

It would be well to have a large number of primary schools as a recruiting ground; and he would prefer to see secondary schools more largely taken advantage of by pupil teachers. Intending teachers should have at least two years in a central school.

Mr. Beattie, Vice-President, gave a hearty reception to the views expressed, and on behalf of the pupil teachers in outlying districts in the Highlands and Islands he pleaded for the sympathy of the Lowlanders. He thought that fifty bursaries of £20 each might be offered to pupil teachers in the Highlands, to enable them to go to central classes.

Mr. H. M'Callum, lately second master in the Pupil Teacher Institute, Glasgow, answered from his experience the objection raised that central schools were mere cramming institutions for Queen's Scholarship Examinations. The results of the Glasgow centre in the Leaving Certificate Examination, he maintained, would compare very favourably with those of the secondary schools; and these results showed that the students were receiving a broad and liberal education. Moreover, the statistics he gave with regard to the number of students who had passed the University Preliminary Examination fully proved that of the central system Glasgow had reason to be proud.

The Secretary of the Institute (Mr. J. Laurence) then moved: "That the time has come when centres for the training of pupil teachers should be established by all large School Boards, and by suitable combinations of small Boards." He quoted various opinions by experts to show that the evidence in favour of the central system was very conclusive. Dr. J. E. Parrott, in supporting, gave his experience of the central system south of the Tweed. To make the best of the pupil-teacher system, he thought there should be central classes—classes taught by competent men who took a broad view of education. Major Mackenzie, Maryburgh, wished the following words added to the motion, in the interests of outlying districts: "and that means be taken to devise measures for removing the disabilities under which the pupil teachers in the remoter districts labour." The addition was at once accepted. On the motion of Mr. James Paterson, Edinburgh, it was unanimously agreed "That the E.I.S. hails with satisfaction the proposals of the Scotch Education Department to raise the standard of training for teachers generally, by the affiliation of the training colleges to the university."

Foreign Members.

It was, perhaps, unfortunate that the delegates from the English and Irish associations should have been called upon at the fag end of a somewhat protracted sederunt. It might be better if they were to speak at the beginning of the second day's proceedings; certainly the committees in charge of future congresses should give the matter their attention and consideration. The N.U.T. was represented by Mr. G. Sharples and Mr. Tom John, and the I.N.T.O. by Mr. R. Brown and Mr. P. Ward.

Mr. Sharples, on being called upon to address the Congress, seemed to feel the exigencies of the time, with the result that keen disappointment was felt by many of us, who had expected some valuable information from him as chairman of the committee in charge of the examinations under the N.U.T. Examination Board—a movement which is on the *tapis* in Institute councils. With the subjects of Commercial Education and the Supply of Pupil Teachers (the two preceding papers) Mr. Sharples must have felt *au fait*, yet he had to desist from entering on these questions. On behalf of the 40,000 members of the N.U.T., he offered warmest greetings to the Institute.

Mr. Ward, Belfast, in name of the Irish National Teachers' Organisation, conveyed their most cordial and generous greetings. He dwelt at some length on the difficulties Irish teachers had to face, on the hardships they were enduring; and the tale of "grievances" was by no means a fanciful one.

The President, in name of the Institute, reciprocated the kind greetings of both associations, and expressed the hope that the grievances of Ireland would soon pass away.

Second Day's Congress.

There was a somewhat larger audience assembled on the second day of the Congress, in large measure due to the fact that the air was crisp and clear, and that the sun shone forth. The second day's proceedings were opened by a paper by Mr. William Malcolm, M.A., F.E.I.S., Director of Technical Education, Lanark County Council, on

The Simplification of Educational Control.

He referred to the different authorities having education under their control—980 School Boards, one-third of which has each less than an average attendance of 160 pupils, and one-eighth less than an average attendance of 100; 238 local authorities in receipt of quotas of the residue grant, and 39 County and Burgh Committees. Enormous progress had been made in elementary education, largely due to School Boards. So far as the larger Boards were concerned, there was nothing but praise due. The same could not be said of the smaller Boards. The petty jealousies of these often created opposition cliques, and frequently interfered with good work. This sort of thing took the heart out of teachers,

and the education of the district was bound to be detrimentally affected.

The present confused state of control of secondary education, and the chaotic state of technical education, ought no longer to be tolerated. Why should Scotland wait for England? He was, however, quite willing to do so if he were assured that the waiting involved the appointment of a Minister of Education for the United Kingdom, who would endeavour to introduce some system for the three countries, having regard to the idiosyncrasies of the different nationalities.

There was much inequality shown with regard to the provision of secondary and technical education by one small burgh, perhaps for some six or seven surrounding parishes. He instanced the case of Lanark, where a penny on the £1 in rate only brought in £50; yet it had equipped, at a cost of £1,200, a very fine school, thanks to the liberality of the Lanark County Council.

There was need, therefore, of simplification, and he proceeded to point out how he thought that simplification might be accomplished. One solution of the problem of educational control—one way in which we might have unification—was to make the county the unit of area, and the local authority for that area would be the County Council, who would appoint an Educational Board for the county; on that Board representatives from the Burgh Councils within the area would have places apportioned according to their valuation or population. Additional members would be co-opted by these, representative of the Department, the universities, the teaching profession, and ladies. This Board would have under its care elementary, secondary, and technical education, and would deliberate and decide on all questions of principle in educational affairs, and would have in its power the appointment of teachers, the fixing of remuneration of teachers, and the like.

This would be the plan if *unification* of educational control were sought for; but if *simplification*—a compromise—were advocated, then an endeavour should be made as far as possible to secure the advantages indicated without involving the supersession of School Boards for elementary work, comprised in the large centres as hitherto, but in the smaller centres with extended areas, either by the amalgamation of several of the smaller Boards or by absorption in a large County School Board; and use should be made of the County Board for higher education.

Dr. Mackay, Treasurer of the Institute, in proposing "That the existing multiplicity of conflicting authorities is prejudicial to the best interests of Scottish education, and that Parliament should be urged to adopt, as early as possible, measures for the simplification of educational control," contended that the difficulties that had been pointed out in the paper were not merely pressing, but alarming. He did not agree with all the points raised, especially with regard to higher education being taken out of the power of School Boards. He thought that order could only arise through unification. Mr. Cook, Greenock, seconded; but on the suggestion of Colonel Martin, Edinburgh, *unification* was substituted for *simplification*, and this became the finding of the Congress.

To Mr. W. Reid, Alva, as Convener of the Institute's Committee on Rural Schools, was entrusted the very important subject of

The Conditions of Service in Rural Schools.

In his opening sentence, by reference to 1900 as the commencement of the twentieth century, he found that the meeting was not prepared to accept this way of characterising the closing year of the century. In the course of an eloquent speech, he said it would be allowed by all that the education of rural districts presented the greatest of the difficulties encountered in the administration of the Act of 1872. When hindrances to education were enumerated, our minds, as a rule, were directed to rural schools. The three points he sought to emphasise were—(1) public indifference; (2) unsatisfactory management; and (3) inadequate financial support.

In dealing with the supply of teachers, he pointed out that the supply of efficient teachers was decreasing, because the profession was becoming unpopular, mainly on account of the notorious insecurity of tenure; but in regard to this we were reaching a crisis, and with it would come the opportunity. He then commented on the meagre and unqualified assistance, observing that by the new Code the inadequacy of the staffing provisions was now more apparent than ever.

Then there was no greater obstacle to school work than irregular attendance. In no point has the disadvantage of the small School Board system been more clearly shown than in this. The recognition in the recent English Act dealing with agricultural districts that a curtailment of educational facilities was necessary, was a most decidedly retrograde step, and he hoped Scotland would never have this blot on its statute-book.

He then referred to the unsuitable buildings and equipments—causes which could not wholly be ascribed to the laxity of local authorities; and in this connection he referred to the remuneration of rural teachers, and advocated the abolition of small School Boards.

Mr. A. Small, president of the Glasgow Assistant Teachers' Association, dealt with the same subject, particularly as it referred to assistants. The ruling principle of many rural School Boards, he thought, was that they were acting solely as the custodians of the public purse. The primary business of School Boards, he maintained, was to advance the highest educational welfare of the community, and the question of rates ought to be a secondary matter. Teachers should be scholars, fixed citizens rather than sojourners, but to an alarming extent rural class teachers were a nomadic race.

From an examination of some 400 schedules, he made bold to say that over 40 per cent. had not served their present Boards more than three years. As a rule, the receipt of the Government certificate was the limit of the class teacher's service with a rural Board, and thereafter he took the first opportunity of migrating to a large town. Constant change in the teaching staff affected adversely the education of the children. The reasons for the frequent changes he gave were insecurity of tenure, insufficiency of remuneration, and the lack of prospects.

When rural School Boards awakened to a sense that their duty to education was superior to, and inclusive of, their duty to the ratepayer; when they, together with the Department, took the necessary steps to raise the teacher, and with him to raise the teaching of the country, he would look upon that as the dawn of a brighter day.

Mr. G. Fenton, secretary of the Scottish Assistant Teachers' Association, moved the following resolution:—"That the present system of parish School Boards is injurious to the cause of education, inasmuch as it engenders conditions of service for teachers which are calculated to deter youths of ability from entering the profession."

The resolution was adopted without discussion.

Second Afternoon's Sederunt.

In the afternoon the first paper was read by Dr. J. Gunn, Edinburgh, who has for many years taken an active interest in the physical education of children. He took as his subject

Some Physical Aspects of the Pupil.

This paper will be found in another part of this month's issue.

On the motion of Mr. S. M. Murray, who expressed the hope that members would have an opportunity of reading the paper, a very cordial vote of thanks was accorded to Dr. Gunn for his interesting and admirable paper.

The last paper of the Conference was read by Mr. J. G. Thomson, ex-President of the Institute. He took as his subject

The Code of 1899: Its Evolutionary Place.

The paper—which abounded in truly "Thomsonian" literary polish, to borrow the president's phrase—praised in no slight measure the enlightened provisions of the new Code. He maintained that Scotland had now a Code quite equal in most respects, and in some respects, as concerns Scottish education, superior to that which governed German schools. From his intimate study of Codes, Mr. Thomson is earning for himself the epithet of "Code-maker" in the best sense of

the term. The evolution of the 1899 Code was on the very confines of perfection. It was as near perfection in things essential as any Code in the world. Though this was the last paper, it was by no means the least enjoyable, and those of the audience who remained had a real literary treat, and the paper formed a valuable and interesting contribution to the Edinburgh Congress.

In reviewing the proceedings of the two days' Congress, it is difficult to say what was its most outstanding feature. The committee had aimed at the papers being practical and business-like; they had cut down the number of papers as compared with those of former Congresses, in the hope that there would be more time for discussion. Their object was only to a very limited extent secured. When members attending Congress make their speeches so long, when one speaker occupies the time that should be taken up by at least six speakers, who can express themselves in a concise, epigrammatic, and thoroughly practical fashion, there is room for improvement. The ponderosity of Congress debates will have to be set aside. It may be true that a discussive Congress might become a discursive one, that crude, ill-digested, and ill-matured opinions might be given; yet surely there might be found amongst the chaff many grains of useful information. Until such time as our Congresses become more like arenas for good debating power, we are losing a valuable means of both educating and enlightening public opinion.

In this connection, it may be said that very much of the success of the Congress was due to the untiring efforts of the committee of the Edinburgh Branch, prominent among whom were Mr. S. M. Murray, convener of the committee, Mr. Wm. D. Elder, treasurer, and Mr. R. G. Dickson, secretary.

Of the

Adjuncts of the Congress,

some of which were of an instructive nature, while others might be characterised as social, we can only say that the exhibit of school books and apparatus was largely patronised, and proved of great value and interest.

The Congress dinner, though not so over-weighted with toasts as in former years, was a great success. The Assistants' Breakfast proved most interesting, the speeches being short and to the point.

Mr. Colin G. Macrae, Chairman of the Edinburgh School Board, and Mrs. Macrae, held a reception of members attending the Congress. This was largely attended, not only by city, but also by country members.

On the Friday succeeding Congress a large number of the members visited the printing and publishing establishment of the proprietors of this journal, Messrs. T. Nelson and Sons, at Parkside. From the expressions of many of those who had the pleasure of being personally conducted over the works, it was evident that the Congress Committee had, in this part of the arrangements, scored a great success.

The orchestral concert in the beautiful M'Ewan Hall formed one of the great attractions. To a large and enthusiastic audience Mr. T. H. Collinson, Mus. Bac. (Oxon.), performed an excellent programme on the grand organ. All were delighted, and at the close an offering for the widows and orphans of the sufferers in South Africa was taken which amounted to £9.

A very limited party in the evening visited the Royal Observatory, and were conducted over the building by Professor Copeland and his assistants. It was unfortunate that for star-gazing the evening was too dull, but the party were compensated for the lack of clearness by the view of the various and magnificent instruments, etc., to be found within the Government building.

It was much to be regretted that, in consequence of the reverses to the British troops in South Africa, the Town Council was prevented from giving the reception and ball so generously offered. This was felt more particularly by the younger members of the profession.

The handbook of the Congress, a beautiful memento of the proceedings, was most artistically executed, and presented to members of Congress, by Messrs. T. Nelson and Sons, to whom the best thanks of the Congress Committee are due. The excellent literary article on Educational Edinburgh, from the pen of the popular and highly-valued Clerk of the School Board of Edinburgh, Mr. James Arnot, M.A., gives to the handbook a permanent value. The book was much sought after by members attending the Congress, and is sure to be prized and valued by those who were fortunate enough to secure a copy.

There is perhaps one point that we would like to refer to ere we close this account of the Congress. It is a hundred pities that the Educational Institute of Scotland, or the Edinburgh Branch, have not made any movement in the direction of giving to the papers delivered at Congress a permanent form. The high merit of the papers given, the attention and care bestowed on them by the readers, the larger audience that would thereby be reached, the great influence they would be sure to exert on Scottish education, combine to warrant the hope that even yet the papers of the Congress will be published in book form, and distributed to all teachers and educationists throughout Scotland.

THE ENGLISH EDUCATION EXHIBITION, 1900.

IT is fifteen years since an exhibition illustrative of education in England was held. We owe the inception of the exhibition which came to a close on the 29th ultimo, to the necessity for the British Isles being adequately represented in the educational section of the Paris Exhibition this year. Education abroad is, as a rule, organised by the various governments. In England, such a collection as was exhibited at the Imperial Institute during January could only be got together by voluntary effort. The committee responsible for the arrangements was representative in character, presided over by Sir George Kekewich, with a most able colleague in Dr. Garnett, secretary of the London Technical Education Board. Applications for exhibits were made to all manner of educational institutions. The response was general, and the result a collection such as has never previously been practicable or possible.

Depicting only the work of its own particular kind, without any but general directions from the central committee, each contributing body followed its own sweet will in selecting its quota; and if it cannot be said that a connected and comprehensive view of the whole field of English education could be obtained by an inquiring foreigner, there was gathered together such a collection as would convince any observer of the extraordinary activity in the field of education at the present time. Every branch was in evidence, from the kindergarten to the university, the great hall and a long corridor lending themselves admirably to the purpose of the exhibition.

The work of primary education was illustrated by collections of articles shown by the National Society, the British and Foreign Schools Society, the Wesleyan Education Committee, the Roman Catholic School Committee, and a large number of provincial school boards, as well as the London School Board. The exhibits included specimens of handwriting, worked examination papers, brush drawing, paper-folding, needlework, cardboard work, drawing, modelling in clay, and other occupations; housewifery, cookery, wood and metal work, through the whole range of these subjects from the infant school to the higher-grade school. The bent of the teacher could be seen in the productions from individual schools, and although none attempted to excel in every subject, the general result was an amount of work whose quality it would be difficult to surpass.

The exhibit of the Brighton School Board, one of the best in the exhibition, was a very successful attempt to illustrate the work of a higher-grade school embracing a school of science, and could not fail to impress favourably all who are objectors to the so-called intrusion of these schools into the field of secondary education. The Manchester School Board united with the Technical Education Committee of the city in an exhibit which showed the value of correlation, if not of unification, of educational authorities. Leeds, as well as London, showed specimens of work from

various types of schools, as well as the work of the blind, deaf, feeble-minded, and other branches of education lately imposed upon them. Hull, Bristol, Sheffield, Ipswich, Grimsby, and other boards, all had satisfactory exhibits. The National Society was well to the fore with work from village as well as town schools. A pictorial history of England scrap-book used for object lessons in the teaching of history, arranged and compiled by Mr. Smith, headmaster of Henham and Wingford N. School, Suffolk, attracted great attention.

The excellence of the manual training was one of the features of this part of the exhibition, and the results will eventually be seen in the increased dexterity, the improved artistic appreciation, and the consequent greater prosperity of the industrial classes of the country. While the backwardness of the English artisan was manifested by the comparisons of the Exhibition of 1851, the defects then shown have been remedied by the work of the Science and Art Department for adults since that date, and the general introduction of drawing and various manual occupations into elementary schools has now laid such a foundation that no difficulty need be experienced in making English work in matters of style, elegance, finish, and neatness equal to that of any other nation.

Secondary schools were by no means so well represented as primary schools; while Eton, Rugby, Marlborough, Haileybury, Dulwich, and other chiefly non-local schools had sent pictures, photographs, and some specimens of their daily form work, the great bulk of the grammar schools and private schools were unrepresented. The various classes of secondary schools for girls and colleges for women were much more in evidence, there being exhibits from the Girls' Public Day School Company, the Church Schools Company, St. Mary's College, Paddington, Allen Olney School, Hampstead, and Maria Grey, Cheltenham Ladies', Cambridge, Royal Holloway, Bedford, and other colleges. From tables analysing the work of 120 preparatory schools, interesting comparisons could be drawn of the differing views of head teachers respecting preparation for scholarships at the secondary schools. Although in some cases work of an advanced character was shown, comparison of similar kinds of work from primary schools did not always show to the advantage of secondary schools.

All the universities and many of the university colleges contributed of their charters, their statutes, pictures, paintings, and class books. In addition to these, Oxford showed the moral philosophy papers worked by Mr. Gladstone; Cambridge, scientific apparatus; Durham, biological and agricultural results; University College, psychological diagrams and apparatus; Leeds, results in dyeing, weaving, and other textile education; London, charters and registers; Reading, specimens of agricultural work and drawings.

The exhibits from schools of art, county council technical schools, the London School of Arts and Crafts, the Polytechnics, the Normal School for the Blind, the Froebel Society, Sloyd Association, the Science and Art Department, the Royal Drawing Society, and others were of a varied and interesting character. The technical work undertaken by the county councils was generally of a character highly appropriate to the industries of the districts, and it seems impossible, judging from the variety of the exhibits, that instruction can be unobtainable in any subject connected with art, science, or industry anywhere in the country.

Only a few of the publishers and manufacturers of school furniture and school apparatus were represented: Messrs. E. J. Arnold and Sons, of Leeds, showed relief maps; G. W. Bacon and Co., maps and diagrams, and drawing-books and cards; Newman and Co., kindergarten books and apparatus; and Cussons, of Manchester, valuable and interesting appliances for technical schools. The University Press and the University Tutorial College had complete lists of their educational publications on view.

A general survey of the whole exhibition enables us to speak in terms of highest praise of the whole work of primary education, and to indulge the hope that the benefits of correlation, as exhibited by Manchester, may become widespread under the ægis of the local authorities to be established by the new Board of Education in the immediate future.

The exhibition was opened on the 5th of January by H.R.H. the Prince of Wales, under the presidency of the Duke of Devonshire. The chairman read an address of welcome to the Prince, detailing the origin and object of the exhibition. In his reply the Prince expressed his great interest in the progress of education, and his good wishes for its extended prosperity.

In connection with the exhibition, a series of lectures, conferences, meetings, and demonstration lessons, arranged by various educational bodies, was held in the East Conference Hall of the Imperial Institute. These were open free to the public, who on several occasions availed themselves in large numbers of the opportunity to be present.

The first of the series of conferences was held under the direction of the College of Preceptors, on Saturday morning, and dealt with the subjects, "The Conditions of the Formation of the Register of Secondary Schools," and "The Sanitary Requirements of Buildings for School Purposes." Dr. Wormell, one of the members of the Royal Commission on Secondary Education, opened the discussion on the first topic. He held that a register of secondary schools should be not simply a list of names, but should supply such information to parents as would enable them to discover the aim of the school, and to judge of its suitability for their children. It should contain the names of public, private, and proprietary schools willing to submit to a test, and schools which were inefficient, whether as regards premises, curriculum, or teachers, should not be admitted. The list should be prepared by the local authority, but an appeal should lie to the central authority from any school whose proprietors considered that they were aggrieved by its non-admission.

Another paper, by Dr. Newsholme, on "The Sanitary Requirements of Buildings for School Purposes," dealt with the two essentials of proper ventilation and warming as at the foundation of all sanitary requirements of schools, especially in the case of private schools usually held in houses, which did not easily lend themselves to the scientific application of rules for ventilation of public buildings.

A paper by H. L. Withers, Esq., M.A., Professor of Education at Owen's College, Manchester, was read in the afternoon on "Examination Tests: Oral and Written;" and another by Miss E. Williams, of Paris, on "Oral Examinations as conducted in France." Mr. Withers deprecated too much examination, as having a bad effect on study, and leading to faulty habits of mind, but pointed out that both examination and inspection were necessary for financial, professional, and competitive reasons, but more especially that the teacher himself might gain a knowledge of the pupils' minds. Examinations should, as far as possible, be conducted by the teachers themselves, although outside examinations were needed to satisfy the governors of the schools, and to prevent the teachers from lapsing into routine, from running too much in a single groove, and to give them a possibility of improving their methods, if necessary, after comparing their work with that of others. Still he felt the evil of having outside examiners, as it almost invariably led to an outside syllabus, to set books, and to cram. Examiners should be in close touch with the teachers, should themselves have had wide and varied experience as teachers, should accept the syllabus of work prepared by the teachers, and should follow it closely. If pupils attended outside examinations, the latter should provide a wide choice of subjects; and the written examination should be supplemented by an oral examination, especially in the case of those leaving school, in order that their power of expressing themselves might be properly tested, the ability to speak and compose being largely neglected in English education.

Miss Williams detailed the various examinations in France, advocating the retention of the oral examination, which is specially necessary in the case of teachers, who thus show their own originality of expression and their ability to impart their knowledge to others. After giving a lesson or reading a thesis, the candidates are expected to defend their opinions in public debate, and on their success in this effort the granting of their diplomas very largely depends.

On Monday, the 8th of January, under the auspices of the Geographical Association, a lecture on "The Use of the Lantern in Education" was given by A. W. Andrews, Esq., M.A.,

and illustrated by a series of geographical slides. A number of bold map outlines, showing the effect of the physical contour of the world on climate, river basins, commerce, and social conditions, as well as various views calculated to instruct and interest a school audience, were thrown on the screen. As the lantern may now be found in almost every large Board school, it must only be the teachers of other schools with whom the lecturer had to plead for the utility of lantern illustrations.

Mr. S. R. Hart read a paper on "The Place of Languages in a Modern School," advocating the dropping of Greek altogether, the delay in the introduction of Latin, and, where possible, the total abolition of the teaching of dead languages in a school where boys were destined to leave at sixteen years of age. He sketched a time-table for such schools, giving in the last year of school life five hours to mathematics, five to German, three to French, and three to science, leaving the remainder (nine hours) to religious knowledge, shorthand, bookkeeping, manual training, geography, English language and literature, drawing, physical exercises, history, and all the other subjects considered necessary in a modern education. If Latin were added, some of the English subjects must necessarily still further suffer. The impression left is that too much time is given to some subjects to the neglect of others, and that the curriculum should in some measure be unloaded, to allow of a better acquaintance with English subjects being obtained.

Tuesday's conference was devoted to papers on "Manual Instruction in Secondary Schools," and "The Adoption of the Metric System in England," both being advocated by the readers of the papers.

The Technical Education Board of the London County Council was responsible for Wednesday's conference. Professor Miall, of Leeds, and Miss Von Wyse gave addresses on "The Teaching of Botany," and Professor H. E. Armstrong one on "Juvenile Research," with experiments by juvenile assistants and lantern slides.

Professor Miall expressed regret that the teaching of botany was not so universal as it ought to be. It should be encouraged as necessary to scientific agriculture by means of practical and experimental teaching. The aim should be to demonstrate the way in which plants discharged the functions of nutrition and reproduction. In the course of the discussion it was shown that where a proper staff is supplied, as in the London Board schools, botany is being practically taught, but it was impossible to graft such a subject with any likelihood of great results where so many other subjects crowded the time-table and the staff was inadequate.

Under the chairmanship of Sir Henry Roscoe, Professor Armstrong gave a lecture on "Juvenile Research," with lantern illustrations, and assisted by his three children, ranging from nine to thirteen and a half years of age. His method involved the necessity for investigation and experiment in early life, which should be carried out in the true spirit of the investigator. To satisfy himself of the feasibility of his propositions, he experimented with his own children, and the results he showed to the audience, together with the methods adopted. An interesting book was purchased, and the story roused inquiry why certain things happened, and the children all set about finding the reason why under his direction. The experiments, the drawings, and the description of what had been done were all entered in notebooks—the three volumes being on evidence. The experiments were nearly all confined to the properties of matter, and consisted chiefly of weighing and measurements. The children described what they had done, and why they had done it, and the results they had obtained. Lantern slides assisted in illustrating the method. This process had been going on for two years. Every one present eulogised the methods, but the inquiry was general as to how they were to be adapted to class teaching, where not three but thirty, or, in a school, three hundred, had to be taught. No satisfactory answer was forthcoming; and in some minds the question arose as to the necessity for compelling the child to discover everything for itself, when, by judicious instruction and guidance, the results of other persons' labours could be imparted. It seems reasonable to suppose that the results of many experiments might be told, provided the child had acquired the habit of independent thought and application. It appears also most reasonable that a judicious mean between too much and too little experiment would be best. Time, opportunity, and consideration for the needs of other subjects were the great factors to determine how far the heuristic method of teaching should prevail.

At the Technical Institute, Shoreditch, on Thursday, an address was given on "Object Lessons in Natural History," by Mr. J. W. Tutt, and on "Metal Work as a Form of Manual Instruction in Schools," by Professor Ripper of University College, Sheffield. The Prout-Newcombe Natural History Collection was used in connection with the former paper, and was viewed with interest by the large company present. The Sheffield, Grimsby, Ipswich, London, and other exhibits at the Imperial Institute demonstrate the adaptability of this subject to the needs of the stronger boys of every class of school. The miserably small attendance at the exhibition is significant of the great apathy and indifference of the public to educational questions.

TECHNICAL AND SECONDARY EDUCATION.

THE minds of many secondary teachers have been agitated during the past few months with the task of filling up the post of Assistant-Secretary for the Secondary Department of the new Board of Education. It is understood that doubts and surmises on the subject have all been set at rest by the appointment of the Hon. H. N. Bruce, son of the late Lord Aberdare, an Assistant Charity Commissioner, and Secretary to the Royal Commission on Secondary Education. Such appointment will not be publicly notified till 1st April.

The arbitrary dismissal of five assistants at Alleyn's (Secondary) School, Dulwich, has led *The Journal of Education* to declare that the only remedy for the condition of things is the establishment of a trades union among assistant teachers. As several of the assistants named are members of the N.U.T., they will have the advantages accruing to membership of a trades union without the name. The cases of Grantham, Oundle, and Dulwich, all occurring within a few months of each other, emphasise the necessity for greater security of tenure, and for the appointment of a court of appeal. Why should not the new Consultative Committee, composed largely of experts, be constituted such?

The whole of the Christmas recess has been devoted to educational conferences. The Head-Masters' Conference, which includes the heads of about a hundred schools sending scholars direct to the university, is drawing into line with the other bodies in favour of one local authority controlling all grades of education, although eventually a somewhat colourless resolution was passed. Contrary also to opinions previously expressed, the need for the training of teachers is now being emphasised more strongly by this association, notwithstanding the views of some few eminent head-masters.

The Modern Languages Association held their annual meeting, and a presentation portrait was given to Professor Skeat.

The annual meeting of the Incorporated Association of Head-Masters was held in the Guildhall, London, on Wednesday and Thursday, 10th and 11th January. Mr. Gow, head-master of Nottingham High School, presided. He indicated the changes likely to happen during the year owing to the passing of the Board of Education Act, and advocated suitable appointments to the clerkships of local authorities sanctioned by the central authority. He deprecated the present system of examinations, and suggested inspection instead. He asked, also, that schoolmasters should be considered not as candidates for high ecclesiastical office, but for the ordinary honours which were given to other professions and to the civil service.

The Bishop of Coventry's scheme for ten local authorities to embrace such areas as would include all types of school, up to and including a university or a university college, was considered at the conference. The resolution carried stuck to the county or county borough as the area, with power to group adjacent districts. Another resolution was carried

which stated that the local authority should have the general control of primary, secondary, and technical education within the local area, it being provided that there should be a right of appeal from the local to the central authority, and that the local authority should not directly administer any school or educational institution. Other resolutions asked that inspection should be conducted by or on behalf of the Board of Education, and that direct representation should be sought on the senate of the new London University. After a long and interesting discussion, the following resolution was carried :—

> "That this association heartily sympathises with the establishment of professorships, lectureships, and other university or collegiate agencies for the post-graduate training of secondary school teachers, and presses upon all those who are preparing for the profession the importance of systematic training in the theory and practice of education, with special reference to secondary schools. It is further of opinion that after five years from the commencement of the Board of Education Act, no new member of the profession should be qualified for a place on the register of secondary teachers who had not undergone some such systematic course of training."

It will be noticed that the resolution confines itself solely to a register for secondary teachers and to training for secondary teachers. As it is not probable that a register for secondary teachers only will be formed, the resolution is somewhat out of place. It is a good sign of the times that training is now considered absolutely necessary. Practical considerations, having regard to the present facilities for training, will require a modification of their demand in the latter part of the resolution.

The question of tenure in secondary schools was discussed with closed doors.

The annual meeting of the Association of Principals and Lecturers in Training Colleges was held at the Imperial Institute on the 11th and 12th, the Bishop of London giving an address; and that of the Association of Directors and Organising Secretaries for Technical and Secondary Education on the 17th January. A further notice of their proceedings may be given in the March number of THE PRACTICAL TEACHER.

DR. PARROTT.

DR. PARROTT.

PRACTICAL teachers all the world over have more than a passing interest in the academic success of those of their fellows who scorn delights, and live laborious days, in their attempts to show the quality of the primary teacher in the university arena. Hence all our readers will be at one with us in heartily congratulating our friend and contributor who presides "At the Sign of the Paper Knife" upon the unique distinction he has won at Dublin, where he has not only succeeded in obtaining the coveted doctorate, heading the list of the successful candidates, but has in the doing thereof scored higher marks than those gained by any other LL.D. for five years past! Most truly may it be said of Dr. Parrott's academic career that "*Finis coronat opus*," and we sincerely hope that in the larger field of literature, as in the academic arena, the newly-made Doctor may go from success to success, and so continue to delight his many friends all over the country. We, who have known and admired Dr. Parrott for many years, are not surprised at the distinction he has won, because of our familiarity with the fact that the worthy Doctor possesses a goodly share of that true genius which consists in the infinite capacity for taking pains, coupled, it is true, with more than an average share of native ability. Hence his success is as deserved as it is great. It may interest many of our readers to know that Dr. Parrott, with blushing honours and academicals thick upon him, had as a fellow-graduate in Laws the Right Hon. Joseph Chamberlain, who received his honorary degree at the same time; and that he was present—as a spectator, of course—when the wigs were thrown upon the green prior to the latest conflict between Town and Gown in "dear, dirty Dublin," to which we need do nothing more than to refer here, for has it not already been recorded in the public press? Now that the Doctor has returned to the classic shades of Modern Athens (otherwise known to men as Auld Reekie), he will not, we hope, long delay giving us the first-fruits of his new dignity, in the shape of some delectable offspring of his well-stored and equally well-trained imagination.

THE NEWEST PUBLICATIONS RECEIVED.

A. AND C. BLACK.—The Englishwoman's Year Book and Directory, 1900. Edited by Emily Janes.

W. AND R. CHAMBERS, LTD.—"Continuous" Readers. The Story of Paul Dombey. Price 4d.—Selected Stories. Price 4d.—Biographical Stories. Price 3d.

GRIFFITH, FARRAN, AND CO.—County Council Scholarship Series. Freehand. Sets III. and IV. By H. W. Clarke. (12 Cards.) Price 1s. 6d.

LONGMANS, GREEN, AND CO.—Cæsar's Gallic War. Book I., with Notes, Introduction, and Vocabulary. By J. W. Bartram, M.A. Illustrated.

MACMILLAN AND CO.—The Uses of the Parts of Speech, as shown by Examples. By J. C. Nesfield, M.A. Price 6d.—Geography Readers. Book I. Price 10d. Book II. Price 1s.

M'DOUGALL EDUCATIONAL CO., LTD.—Advanced Literary Reader. Selections from Modern Authors, Newspapers, and Magazines. Profusely illustrated. Price 1s. 6d.—Petite Esquisse de la Littérature Française. By J. E. Mansion, B. ès L. Price 1s. 6d. net.—Summary of British History for the Upper Standards, with Maps. Price 8d.—Exercises in Book-keeping. Stages I. and II. By James Barnetson. Price 2d. each.

SIR ISAAC PITMAN AND SONS, LTD.—Commercial Correspondence in Shorthand. Price 2s. 6d.—Commercial Correspondence in German. Handelskorrespondenz. Price 2s. 6d.—Commercial Correspondence in French. Correspondance Commerciale. Price 2s. 6d.—Commercial Correspondence and Commercial English. Price 2s. 6d.

R. J. PORTEUS AND CO., LTD.—The Newcastle Practical Geometrical Problems and Tests. To Scale. Standards V. and VI. Price 2d. and 2½d.

UNIVERSITY CORRESPONDENCE COLLEGE PRESS.—Ovid: Metamorphoses. Book I., Lines 1–150. Edited by A. H. Allcroft, M.A., and B. J. Hayes, M.A. Price 1s. 6d.

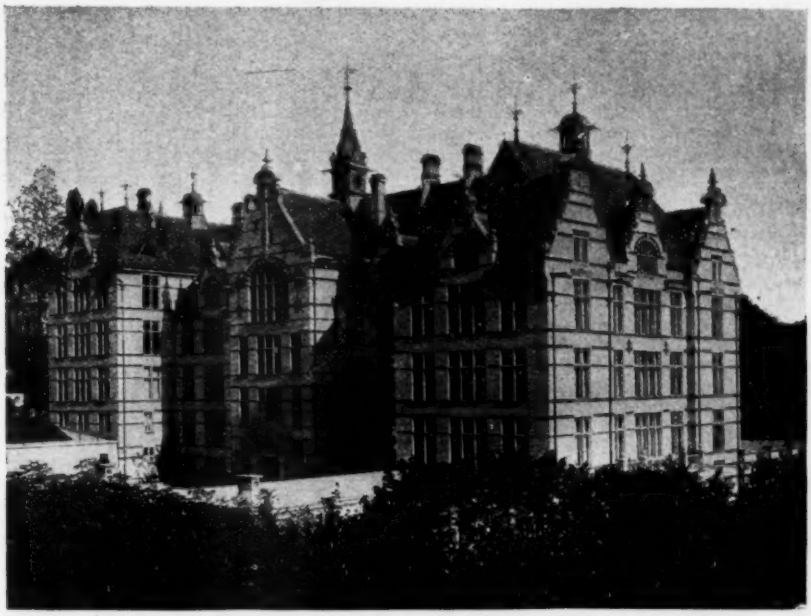
WHITTAKER AND CO.—Volumetric Analysis. By J. B. Coppock. Price 2s.

EDUCATION ABROAD.

I. THE HIRSCHENGRABEN PALACE FOR GIRLS AT ZURICH.

BY the courtesy of Herr F. Fritschi, president of the Swiss National Union of Teachers, and editor of the leading educational organs of Switzerland, we are able to present our readers with illustrations of these beautiful school buildings, which are said to be of the finest on the continent of Europe.

The school, which was completed in 1894, under the superintendence of Mr. Alex. Koch, architect, of London, stands on what was formerly a large garden, the property of an old family of the town. The ground area is one and two-thirds of an acre, and cost £12,216, 8s. The length of the school is 194 feet, and the height 74 feet. The main building is flanked by two spacious gymnasiums. In addition to twenty-two ordinary classrooms, there are—(1) a drawing-room ; (2) a room for natural history collections ; (3) a special room for the teaching of chemistry ; (4) three rooms for the teaching of needlework ; (5) a teachers' room ; (6) a bath and two toilet rooms, and the large hall for singing classes, teachers' meetings, public lectures, etc.



EXTERIOR VIEW OF THE HIRSCHENGRABEN SCHOOL.

The classrooms measure 36 feet by 22 and 14 feet, the younger pupils each enjoying 212 cubic feet of air space, and the elder 265 cubic feet. All rooms are light and bright, the total area of the window-panes being equal to one-fifth of the area of the floor. The school is also provided throughout with electric lights of both kinds—incandescent and arc. The corridors are 11½ feet wide, and are connected with commodious lobbies for the children's clothes. The heating throughout is by warm water. The bathroom is provided with shower-bath pipes, and fitted to accommodate twelve pupils at one time. Two large playgrounds are situated one on the north and one on the south side of the building. On the east side of the school a portion of the old garden remains, with its many beautiful trees, and the original entrance gate.

Special care has been bestowed upon the ornamentation of this truly magnificent school. At the entrance one meets the busts of Pestalozzi and Leonhard Usteri, the latter having founded the first girls' school at Zurich. In the vestibule to the right is an ornamental chimney with figures of two young girls representing study and play, one with book and flower, and the other with a tennis racket.

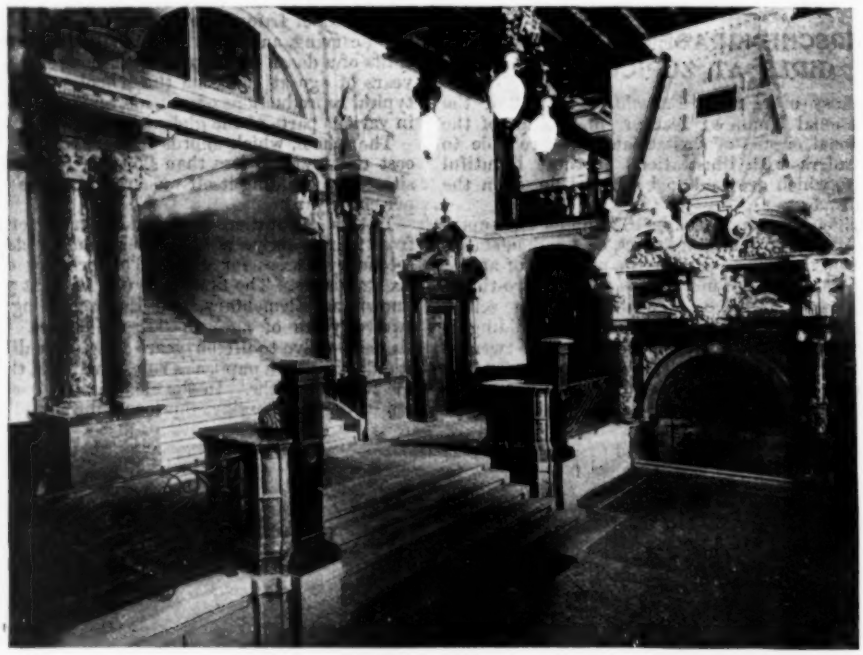
In the large hall there are paintings illustrative of some of the best of Lafontaine's fables, a great amount of exquisite wood-carving, and some fine stone-carving representing portraits of a dozen of the prettiest school-girls who were fifteen years of age at the time the school was built. There are typical reproductions of animals, and of the races of mankind in various parts of the globe.

The school, which affords accommodation for 1,200 girls, cost the town no less than £59,542, 14s. 10d., including the site. The building itself was erected at the cost of 15s. 2¼d. per cubic yard.

In this school there are a kindergarten for boys and girls from four to six years of age, ten primary classes, and eleven secondary classes for girls. The primary classes comprise six standards. The first three (six to eight years of age) are known as Elementary, and the remaining three (nine to twelve years of age) as "Real" classes. The secondary classes (twelve to fifteen years of age) are divided into three standards. Each pupil, as a rule, remains in the same standard for twelve months. In the elementary classes the three R's, object lessons, singing, outdoor games, and gymnastics are taught. The fourth form, being the first of the "real" classes, takes *heimatkunde* and drawing as new subjects. In the fifth course geography, history, natural history, and geometry follow, and are continued in the sixth form. In the first class of the secondary school, at the age of thirteen, the pupils begin to learn French ; in the second class, book-keeping ; and in the third, algebra and English. The last-mentioned subject being optional, is taken up by about four-fifths of the pupils. Needlework is compulsory, and a complete course extends over seven years, from the third class in elementary to the third class in the secondary school. Religious instruction is given twice a week to all pupils from six to fifteen years of age, but this is optional, and the teaching is undenominational in the primary and denominational in the secondary school—in the latter case the instruction being given by the clergy, and in the former by the teachers themselves.

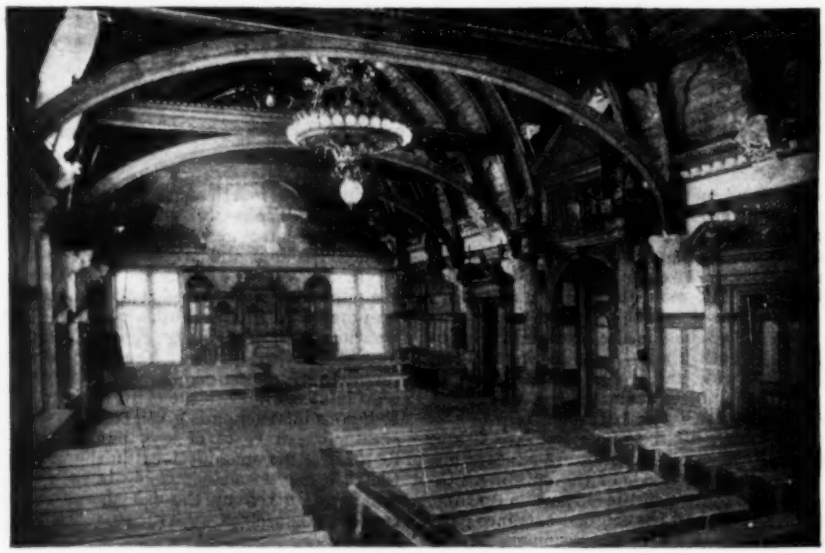
There are no school fees whatever, and, as in the case of all primary and secondary schools in the canton of Zurich, all books, writing and drawing materials, etc., are supplied by the Commune and the Cantonal Government. Poor and well-deserving pupils of the secondary school get premiums

of from eight shillings to two pounds as encouragement, and also partly as an equivalent to parents for the small earnings they might obtain by sending their children to work instead of allowing them to continue the educational course. The Swiss reason thus: Just as the Swiss Government compels every young man of sound body to do military service, and has, therefore, to pay all expenses which the fulfilment of such duty necessarily involves, so when the Government compels every father of a family to send his children to school, instead of turning them out to work for their daily bread at a premature age, the obligation of meeting attendant expenses rests with the Government.



THE VESTIBULE.

mind that the rich in Switzerland would be equivalent to the "well-to-do" in England. On the other hand, the poor are not as destitute as the poor of our great cities. In Switzerland it may be said that the highest and the lowest rungs of the social ladder are unoccupied. The attendance at the primary school is compulsory for six years, and at the secondary school it is optional; but in 1900 a new law will come into operation which will provide for two additional classes in the primary schools. Parents will then be compelled to send their children to a primary school for eight years, or after their sixth year of school life to send them to a secondary school for at least another two years. The



THE LARGE HALL.

The Hirschengraben School is largely attended by girls of all classes, both rich and poor; but it must be borne in mind that the rich in Switzerland would be equivalent to the "well-to-do" in England. On the other hand, the poor

probable result of this measure will be that the better pupils will pass into the secondary school, while the weaker ones

will continue in the primary school, where foreign languages need not be wrestled with.

TABLE OF SUBJECTS AND NUMBER OF LESSONS WEEKLY.

	Primary School.						*Secondary School.*		
	Elementary Classes.			Real Classes.					
Class.....	I.	II.	III.	IV.	V.	VI.	I.	II.	III.
Year of Age....	7	8	9	10	11	12	13	14	15
Religion.....	2	2	2	2	2	2	2	2	2
German.....	8*	8½†	9†	6	6	6	5	5	5
French.....	—	—	—	—	—	—	5	5	5
English.....	—	—	—	—	—	—	—	—	3
Arithmetic.....	6	7½	7	6	5	5	4	3	1½
Book-keeping.....	—	—	—	—	—	—	—	1	1
Algebra.....	—	—	—	—	—	—	—	—	½
Geometry.....	—	—	—	—	1	1	1	1	1
Geometrical Drawing....	—	—	—	—	—	—			
Heimatkunde.....	—	—	—	2	—	—	—	—	—
Geography.....	—	—	—	—	1½	1½	1½	1½	1
Nat. History and Science	—	—	—	2	1½	1	1½	1½	2
History.....	—	—	—	—	1	1½	2	2	1
Writing.....	—	1	1	2	2	2	1	1	1
Drawing.....	—	—	—	2	2	2	2	2	2
Singing.....	—	2	2	2	2	2	2	2	1
Gymnastics and Games..	2	2	2	2	2	2	2	2	2
Needlework.....	—	—	4	6	6	6	4	4	4
Weekly Total.....	18	23	27	32	32	32	31	33	33

* Including Writing and Object Lessons. † Including Object Lessons.

able to write a simple composition, to know a little grammar and the four elementary rules of arithmetic. There are ten weeks' holidays during the year, proportioned in the following manner:—July, four weeks; September and October, three weeks; New Year, one week; spring, two weeks.

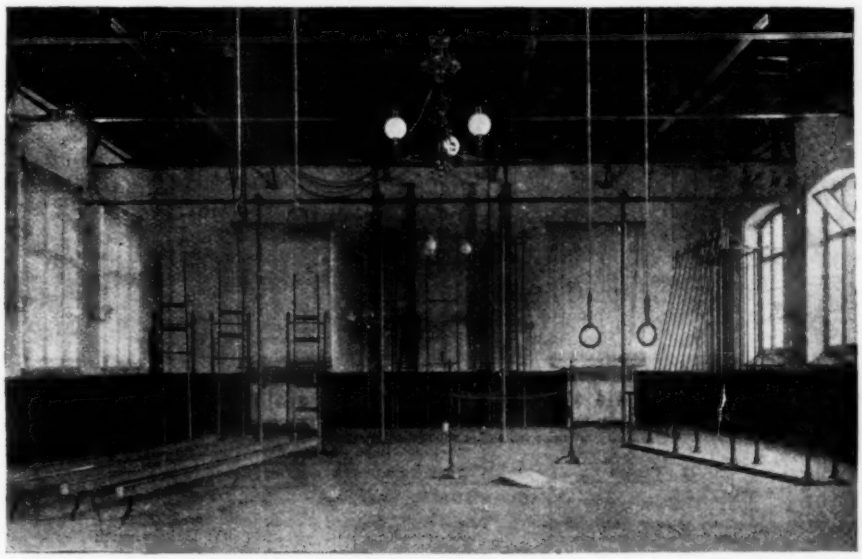
The language spoken in the district is German, and this language is the medium of instruction; but for pupils from a French-speaking district a special course of German instruction is arranged. The instruction is free. Each pupil pays an entrance fee of five francs, and a promotion fee of two francs on entering a new class. Pupils who take the special German course pay a fee of twenty francs.

The curriculum of the lower schools embraces the ordinary school subjects, including modern languages.

THE UPPER SCHOOL.

CLASSES FOR GENERAL CULTURE.

The classes for general culture are devised to suit the requirements of girls who wish to add to their knowledge. Pupils must be fifteen years of age, and must have passed the fifth class of the Lower School. The course lasts two years. Pupils in the first year must attend sixteen, and in the second year twelve hours weekly.



THE GYMNASIUM.

The obligatory subjects in the first year are:—

German	3 hours weekly.
French	4 ,, ,,
History	2 ,, ,,
Geography	2 ,, ,,
Natural Science	2 ,, ,,
Drawing	2 ,, ,,
Class Singing	1 ,, ,,

The following optional subjects may be taken:—

English	4 hours weekly.
Italian	3 ,, ,,
Needlework	4 ,, ,,
Gymnastics	2 ,, ,,

The compulsory subjects in the second year are:—

German	3 hours weekly.
French or English	3 ,, ,,
History	2 ,, ,,
History of Art	2 ,, ,,
Natural Science	2 ,, ,,

II. THE MONBIJOU GIRLS' SCHOOL AT BERNE.

This school is separated into two great divisions—a Lower School and an Upper School. The Upper School is again divided into three parts:—

1. Classes for General Culture.
2. Commercial Classes.
3. Training Classes for Teachers.

It is quite common abroad to find the upper part of girls' schools divided in this manner. Obviously, girls from fifteen to eighteen years of age continue their education for different reasons, and this division of the upper courses is an attempt to meet the various needs.

THE LOWER SCHOOL

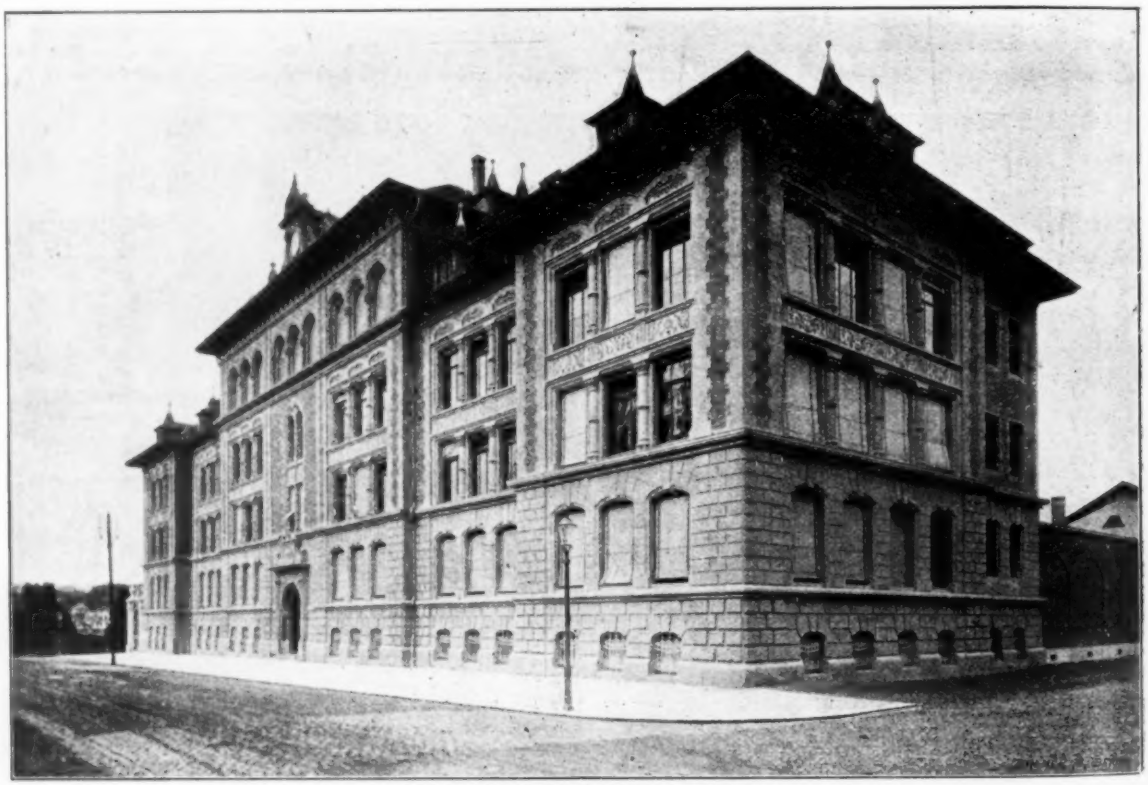
is made up of a five years' course. Children may enter at ten years of age. They are expected to read a passage from a reading book easily, to understand the context, and be able to express themselves grammatically. They must also be

The optional subjects are :—

English	3	hours	weekly.
Italian	3	,,	,,
Psychology and Educational Principles	3	,,	,,
Gymnastics	3	,,	,,

The yearly fee for the whole course is sixty francs. This course is admirably arranged for girls from fifteen to seventeen years of age who have no special career before them. Some details of the work will show how carefully literature is fostered.

The German lessons include a study of Goethe, Schiller, and some of the chief works of other German poets. *Marie Stuart*, *Jungfrau von Orleans*, *Egmont*, *Iphigenie*, were included in the literature in 1898–99. *Little Lord Fauntleroy*, *Three Men in a Boat*, *Helen's Babies*, *Andersen's Fairy Tales*, Tennyson's *May Queen*, were among the English books to be read. The wisdom of choosing interesting and colloquial passages for reading is obvious. It is torture to require pupils to read a classic poem or play during the early years of their study of the language.



THE MONBIJOU GIRLS' SCHOOL AT BERNE.

Commercial Classes.

This course is of two years' duration. It is designed to meet the needs of girls who intend to enter upon a business career, especially as postal or telegraph clerks. Pupils must be fifteen years of age, and must have passed through the lower school or have passed creditably through the primary school, and have a sufficient knowledge of French to enable them to attend the classes with profit. The fee is sixty francs yearly. Pupils must attend twenty-four hours weekly.

The obligatory subjects during the first year are :—

German	4	hours	weekly.
French	4	,,	,,
Arithmetic	3	,,	,,
Book-keeping	3	hours	weekly.
Geography	2	,,	,,
History	2	,,	,,
Laws of Commerce	1	,,	,,
Natural History	2	,,	,,
Writing	2	,,	,,
Shorthand	1	,,	,,

The optional subjects are singing, Italian, English, and needlework.

During the second year the obligatory subjects are :—

French	4	hours	weekly.
English or Italian	4	,,	,,
Arithmetic	4	,,	,,
Book-keeping	3	,,	,,
Correspondence	2	,,	,,
Geography	2	,,	,,
Political Economy	2	,,	,,
Commercial Laws	3	,,	,,

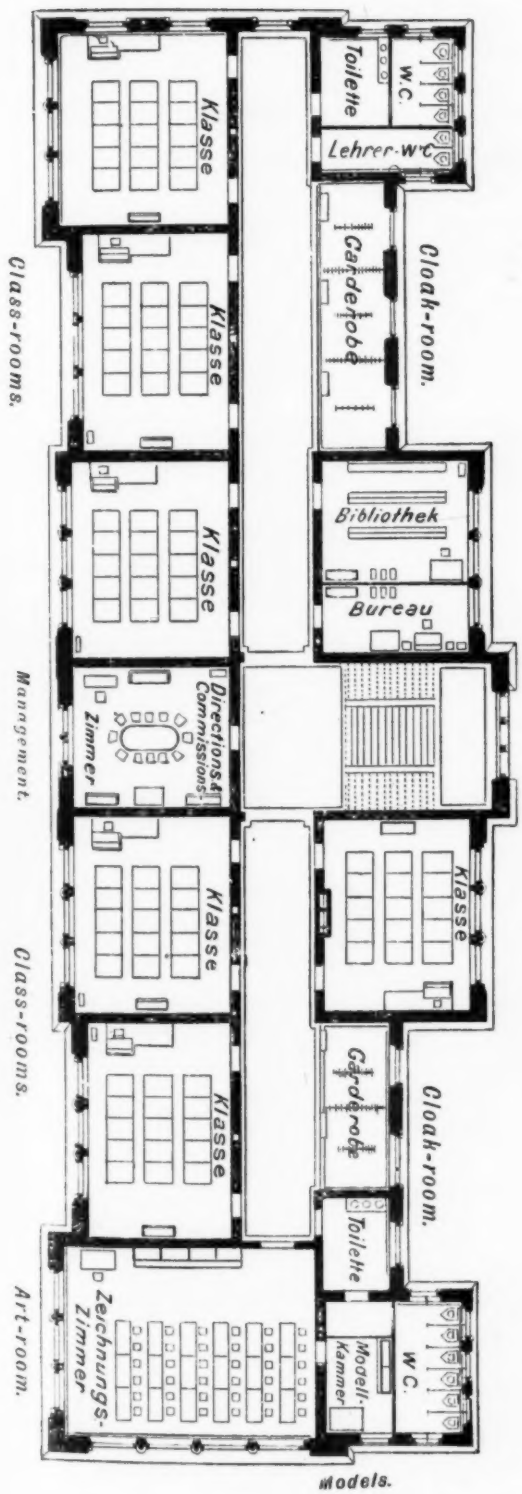
At the end of the two years' course pupils are examined, and receive a diploma.

Training Classes.

The aim of the training classes is to produce good teachers. The course continues for three years. Pupils must be fifteen years of age, perfectly healthy, and show some ability which renders it likely that they will be useful in the teaching profession. The fee is sixty francs yearly. Pupils in the training classes must attend for thirty-two, thirty-three, and thirty-four hours weekly.

The following table shows the subjects of study, and the number of hours spent in each. Class I. is the highest class :—

	Class III.	Class II.	Class I.
Religion	2	2	2
Pedagogy	—	3	3
Method and Criticism Lesson	—	—	4



	Class III.	Class II.	Class I.
German	5	5	4
Mathematics	4	3	3
History	2	2	2
Natural History	4	3	3
Drawing	2	2	2
Writing	2	2	—
Singing	3	3	3
Needlework	4	4	4
Gymnastics	2	2	2

The optional subjects are French, English or Italian, and harmonium playing.

In connection with the training course there is a pattern school of four classes. The training students visit the school and listen to the class teaching during the second year of training. In the third year the students attend special lectures on methods of teaching the various subjects included in the pattern school curriculum; also, the students give criticism lessons in this school. In addition to this, the students are expected to teach in one of the primary schools of the town for a week at a time, and to conduct a whole class without help.

Next month, under "Education Abroad," will appear an account of THE COMMON SCHOOLS OF RUSSIA, by a Special Correspondent.

EDUCATION DEPARTMENT.

CIRCULAR TO TRAINING SCHOOLS OF COOKERY AND LAUNDRY WORK.

Registration of Attendances.

WHITEHALL, LONDON, S.W.,
January 10, 1900.

SIR, OR MADAM,—My Lords find it necessary to call the attention of the committee of each recognised training school of cookery and laundry work to the subject of the correct registration of the attendances of the students at the different classes, and I am to request accordingly that the following rules may be observed:—

I.—Separate registers should be kept for cookery and laundry work.

II.—The registers in each case should show in separate columns the number of hours spent in practical work, demonstration, science, adult teaching, and children's class teaching.

III.—All theoretical teaching is included under the head of science, and may be marked separately or under the one head.

IV.—Attendance at each meeting should be marked at the commencement of the lesson by a stroke thus / in the attendance column.

V.—The number of hours spent at each class, or details of attendance, should be marked before the end of the day. No attendance, or details of such attendance, should be entered after that date, and on no account should registers be taken home to be marked; they should always be kept in the school.

VI.—There should be no erasure or marking in pencil.

VII.—The number of hours in each section of the training should be totalled every week and correctly dated.

VIII.—The registers should be tested at least once each term by some member of the committee of management, and the fact recorded in the registers.—I have the honour to be, Sir, or Madam, your obedient servant,

G. W. KEKEWICH.

THE TENURE OF TEACHERS IN SECONDARY SCHOOLS.

THE precarious nature of the tenure by which teachers in secondary schools hold their office has been engaging the attention of the educational world for some time past, and it is not surprising to find that the Grantham case, and the more recent and extraordinary Dulwich case, have spread dismay throughout the teaching profession. The Executive of the National Union of Teachers have had the whole matter under consideration, and have expressed their opinion that the conditions under which the majority of assistant masters in secondary schools hold their office are such as to be prejudicial to the education given in such schools.

OUR CLASS ROOM AIDS

NOTES OF A LESSON ON WATER.

By WILLIAM DONE, B.A., *Head-Master of Brighton Pupil Teachers' School.*

Articles of Illustration.—**The Object Lesson Supplement accompanying this month's "Practical Teacher;"** three glass tumblers; some water; some sand; a little ordinary mud; a flower-pot with a small piece of glass tubing fitted into the hole; some wood charcoal; some fine gravel; some salt water; a spirit-lamp, and a flat dish for evaporating; a small funnel; and a piece of sponge.

HEADS.	TEACHING.
I. *Water necessary to support Life.*	Ask if any child has passed a whole day without drinking. Refer to the satisfaction experienced of quenching thirst. Is water necessary for plants also? May we then say that animals and plants cannot exist without water? 'In this country rain falls frequently, and hence we have an abundance of springs, rivers, small lakes, and ponds, from all of which we may obtain water. Are there any tracts of land where rain seldom or never falls, and consequently where water is practically unobtainable? Show the illustration of the desert. What does the group of palm trees indicate? Why is the camel called the "ship of the desert"?
II. *Simple Experiments and Observations to ascertain other important Characteristics of Water.*	Take the glass of clear water, and by comparing it as regards colour with other objects, elicit that it is *colourless*. Furthermore, it has no distinct flavour of its own; hence when we mix water with any other flavouring substance, we still preserve the distinct taste of that substance. We next find out that water has *no smell*. Any drinking water possessing smell should be at once rejected, as possibly containing some noxious impurity. Take a pinch of salt and mix it in the glass of water: it disappears. Ask for other substances which we can treat in a like manner. Evidently water *can dissolve many materials*. Light the spirit-lamp; hold a slate in front of it: it hides the light. Replace the slate with a glass of water. We ascertain that water lets light pass through it. It is *transparent*. Pour water from one vessel into another. Compare with treacle or tar. Water *flows readily*. Take a marble, place it in two differently shaped vessels: it retains its own form. Pour water from one of these vessels into the other: water *easily changes its shape*. Place a small cube of wood in an empty glass. Tilt the glass, and note that the top or surface of the wood becomes tilted also. Take a glass half full of water and act in a similar manner: the *water retains its level surface*.
III. *Suspension and Solution.*	In one tumbler again mix a little salt with water until it dissolves. Place some sand in another tumblerful of water, and some mud in a third. Stir well. We find that these substances will not disappear, but remain floating about in the body of the liquid while we are stirring, and gradually settle at the bottom of the glasses when the liquid is at rest. Moreover, the sand settles much more quickly than the mud, so that if we are careful, we can gently pour off the clear water, or decant it, as it is called. We noticed that the mud did not settle so quickly. Let us take a small piece of blotting-paper and line the inside of our small funnel. We will now pour some of the muddy water through this: it comes out clear. If we proceed in a similar way with the water that had the salt dissolved in it, we shall find that it still tastes salt. Therefore substances floating about or held in suspension in water may be removed by what we call filtration, but substances in solution cannot be so removed. While these experiments have been proceeding, a small quantity of the salt water might have been evaporating in a small flat dish over the spirit-lamp. If now it is ready, call attention to the white substance deposited. Let a child taste it: it is the salt. So substances in solution may be recovered by means of drying up or evaporating the liquid in which they are contained.
IV. *A common Filter.*	Construct a common filter before the class. Take the flower-pot in the hole of which a small piece of glass tubing has previously been fastened with a cork. Over the upper end of the glass tube place a small piece of sponge. Next put a layer of small gravel to a height of two inches, above this a similar layer of charcoal, and on the top some sand. Pour a glass of muddy water through the filter: it issues clear; so that our contrivance acts as the blotting-paper acted—it removes from water matters which may be in suspension. If there are any water-works in the neighbourhood, refer to the filtration beds in these, consisting, most probably, of reservoirs with layers of gravel and sand, with perforated tubular drains below. The filter in the diagram has porous earthenware cylinders and charcoal. By means of the cylinders the water is aërated, and it is claimed that they can arrest any micro-organisms which may be in it.
V. *The Travels of a Drop of Water.*	Ask for the name of the largest bodies of water we possess. Give some idea of the size of an ocean by the time a swift steamboat will take to cross one—say a voyage from Liverpool to New York. Let us examine the picture of the open sea before us. The sun is shining, and will draw up some of the water in the form of vapour, to form the clouds we see high up in the cooler regions of the air. The clouds are wafted over the sea, and reach, perhaps, some hilly land, as in the picture. Here they are cooled down further by striking against the colder land, and the water-vapour turns to little globules of water, which run together and form drops too heavy to float in the air, so, consequently, they fall as rain-drops. Some of the rain sinks into the earth, some stays on the surface, and may help to form a pond, a lake, a stream. The stream may eventually run into the ocean, and the water find its way back to the place from whence it came.

CLASS LESSONS IN DOMESTIC ECONOMY.

BY ETHEL R. LUSH,

Author of "Chats with Children on Domestic Economy," etc.; late Organising Mistress to the Ipswich School Board, and Head-Mistress of the Ipswich Higher-Grade Girls' School.

STANDARD VI.

Lesson XXVII.

THE DWELLING: CHOICE OF A SITE.

YOU have, doubtless, often amused yourselves, not so very long ago, by building play-houses with toy-bricks, or by fashioning dolls' houses. In the next few lessons I want you to imagine that you are entering upon the more serious business of building a real house with bricks and mortar—one that shall not only be big enough to live in, but built on the very best lines from a hygienic point of view.

What is the first thing to decide upon? Not the size, nor even the style of architecture: we must first fix upon the *site*.

Of course we should like our house to be picturesquely situated; and if this can be managed without sacrificing the healthiness of the site, so much the better. It is, however, the latter condition which must receive our first consideration.

In selecting the site of a house, both *soil* and *slope* must be taken into account. Some houses, otherwise well built, are little less than death-traps to their inmates, owing to the nature of the soil on which they stand. Thus, a house built upon damp soil will invariably inflict rheumatism, or perhaps some affection of the lungs, upon those who are unlucky enough to dwell in it. Let us deal with this question of damp and dry soils first.

The nature of the soil varies in different localities. In one place we find sandy soil; in another, gravel; in a third, clay; and so on. Broadly speaking, and viewing the matter purely with regard to building-sites, these soils may be divided into two classes—(*a*) those that allow water to drain through them, and (*b*) those that are non-porous. The first we call *pervious* or *permeable soils;* the second, *impervious* or *impermeable*.

The difference between the two kinds may be simply demonstrated in this way:—Here is a glass jar of gravel; a few days ago I poured in sufficient water to fill one-third of the jar. Now you may observe that of the three strata which are distinctly visible, the uppermost is dry, the middle one moist, and the lowest quite a pool of water. On pouring a little more water into the jar, you will see how quickly it passes downwards away from the surface layer.

How different are the results in our next experiment! Here we have a shallow tray filled with clay, upon the surface of which I pour water, just as in the case of the gravel. But in this instance, instead of percolating into and through the soil, the water remains on the surface and forms a puddle. I need scarcely tell you that gravel is a pervious soil, while clay is the best example of an impervious soil.

Sand, sandstone, and chalk may be classed with gravel; limestone and granite are non-porous like clay.

From these experiments we learn that if a house is built upon gravel or sand, the water after each rainfall will sink into lower strata, away from the house, leaving its walls and basement free from damp. On the other hand, water falling upon a clay foundation remains on the surface, and if not drained away, moisture rises through floors and walls, and the house is damp and unhealthy.

Before leaving this question of soil and site, let me warn you against houses built upon "*made soils.*" It is a common practice in towns to fill up such excavations as worked-out quarries and brickfields with various kinds of refuse—road-sweepings and the contents of dust-bins and middens, for instance. This serves the double purpose of providing a place of deposit for the rubbish, and bringing the surface once more to a level. Such a soil is naturally full of decaying animal and vegetable matter, which for a very long time will continue to decompose, giving off foul gases and odours; these are drawn into the house by the heated atmosphere, and poison the air breathed by the inmates. Numerous cases of typhoid fever and diphtheria can be traced to this cause; and even where results are less serious, general ill-health is produced. Moreover, a "made soil" is apt to subside or settle from time to time, causing the walls of the house to crack, or the drains under the house to leak at their joints. From these facts it is clear that no house should be built upon "made soil" for several years.

The *slope of the ground* is another factor which must be taken into consideration. As a general rule, build your house upon as high ground as possible; in this way you not only secure a good view of the surrounding country, and free circulation of air round the house, but the house is also more likely to be dry. Water drains naturally from a high level to a low one: if I prop up my tray of clay so that it slopes like a hillside, the water runs readily downwards to the lowest point, leaving the higher parts comparatively dry. A clay soil near the top of a hill will in all probability form a drier site than a gravel soil at the foot of the hill.

I have pointed out to you what are the most desirable features of a building-site from a "health" point of view; but, unfortunately, it is not always possible to secure a site which shall possess all these qualifications. For example, it is frequently necessary to build upon impervious soils; and in that case the site must be rendered dry artificially, by a *system of drainage*.

This is best effected by laying down under the surface of the ground a set of porous drain-pipes—those made of red brick are excellent—into which the ground-water passes and is carried away to the nearest water-course. Another method is that of using glazed earthenware pipes, perforated along the upper half; and in some towns the sewers are used to carry away rain-water. This plan is not to be recommended, because where water can pass in, sewer-gas can pass out, and there is likely to be fouling of the soil which forms the site, and an escape of sewer-gas into the house.

How very important to health is the drainage of the soil in districts where clay exists, is shown by the marked diminution of the death-rate, and the decrease of the various diseases caused by damp, in towns where drainage of the subsoil has been adopted.

The aspect of the house—or, in other words, the direction in which it faces—must also be considered if we wish our house to be healthy. The windows of the principal living-rooms should face *south* and *west*. Human beings, like plants, require the light and warmth of the sun if they are to keep in health. Plants grown in a cellar are pale and sickly, and even window-plants will not bloom if the sun does not shine upon them. Similarly, children brought up in narrow alleys and courts, where the height of the buildings keeps out the sun, are pale in face and stunted in growth. Avoid, wherever possible, living or sleeping in a room with a northern aspect; without the kindly aid of the sun, the room is likely to be cold, damp, and dark.

I have already pointed out to you the desirability of securing free circulation of air round the house. Houses shut in closely by other buildings or by trees suffer in this respect, and it is difficult to keep them satisfactorily ventilated. If the house is near to a pond, lake, or river, it is likely to be damp, unless placed on rising ground. If it is near large factories or chemical works, the surrounding air is of an impure nature; if it is near a graveyard, the water supply may be polluted, or foul air may rise through the cellars into the house. From all this we learn that in choosing a site for our house, we must take the *surroundings* into account.

Having selected a building-site which fulfils all the foregoing conditions, it behoves us to see that our house is built with special precautions against damp. Ordinary red building bricks are so porous that each one is capable of absorbing a pint of water; moreover, they possess the power of conducting moisture one to another. I can demonstrate my meaning very clearly by placing three or four lumps of sugar one upon another. The bottom lump stands in a little water, but the others are quite dry. If you watch, you will

see that the moisture rises gradually upwards from lump to lump, until the whole pile is saturated. We learn from this that if the bricks which form the foundation of the house are damp, the walls will be damp too. We must guard, therefore, against the entrance of moisture either through the floor or through the walls.

To secure a dry basement, and consequently dry floors, a bed of concrete from twelve to eighteen inches thick should be laid under the foundation, extending some six inches beyond the outer edge of the walls.

A further precaution is to provide what is known as a *dry area*. There is more than one way of doing this, but the method shown in the following sketch answers every purpose. In this case the dry area is secured by digging a trench round that part of the house which would otherwise be in contact with the soil. In the space thus made air freely circulates, and dry cellaring is ensured.

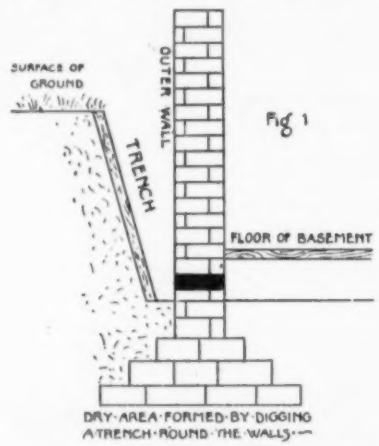


Fig 1

Dry walls are gained by providing a *damp-proof course*. This is nothing more or less than a layer of some impervious material built into the walls just above the level of the ground, and running all round the house (Fig. 2). Frequently hard, blue, glazed Staffordshire bricks are used for this purpose; or sometimes a sheet of lead, a layer of glazed tiles or pitch, or slate set in cement, may be substituted. If I build a second pile of sugar, and slip a thin piece of tin or glass between the first and second lumps, you will see that though the bottom lump is quite wet, the others above the tin —which in this case represents the damp-proof course—are quite dry. It is clear that a damp-proof course acts by preventing the passage of moisture from one brick to another.

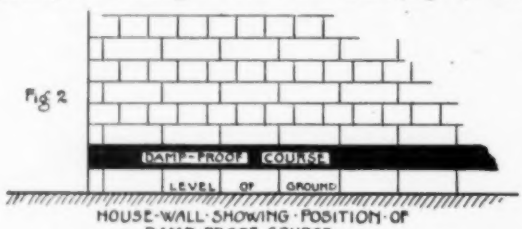


Fig 2

We have seen how to prevent damp from passing upwards through the walls; to prevent it from running *down* the walls, the roof should come out some distance beyond the walls, and be provided with a good iron gutter leading into a rain-water pipe which runs downwards outside, and well away from the walls. Junctions in the roof, such as at the base of the chimney, or where two gables meet, should be specially protected with lead, otherwise there is a likelihood of a leaking roof.

SUMMARY.

A dry house is necessary to ensure health. In selecting the *site* the following points must be considered:—

1. *The soil.*—This must be of a porous nature, to allow the rainfall to percolate to lower strata. Non-porous soils should not be used as sites unless they are drained.

Examples of porous soil—sand, gravel, chalk, sandstone.

Non-porous soils—clay, granite, limestone.

Made soils decompose, and give off foul gases; they are therefore not suitable for building-sites.

2. *The slope.*—Houses should be built on high ground, so that water may drain naturally away from the house to lower levels.

Drainage of the soil may be effected artificially by laying down a system of porous drain-pipes, into which the ground-water passes and is carried away.

3. *The aspect.*—A healthy house should face south-west, so as to secure the maximum of sun.

4. *The surroundings.*—The proximity of high trees or buildings prevents free circulation of the air round a house. Sheets of water, or rivers, make a house damp. Chemical works and factories poison the air.

To secure a dry house, provide—(*a*) a bed of concrete under the foundations; (*b*) a dry area round the walls of the basement; (*c*) a damp-proof course in the walls, just above the level of the ground; (*d*) an overhanging and well-guttered roof.

PRACTICAL ELEMENTARY SCIENCE.

AN EXPERIMENTAL COURSE COVERING THE REQUIREMENTS OF BOTH THE DAY AND EVENING SCHOOL CODES IN PHYSICS AND CHEMISTRY.

BY THOMAS CARTWRIGHT, B.A., B.SC.,

Author of "Practical Chemistry," "'Section One' Physiography," etc.

Measurement.—Having studied the properties of matter, the next natural thing to do is to proceed to the measurement of these properties. It is not enough to know that a lump of iron has weight, or that a piece of string has length. Almost instinctively we push the inquiry a step further, and ask how much weight, how much length, etc. To properly answer these questions is possible only when the meaning of measurement has been adequately grasped. And so it is always. Science is first of all qualitative and then quantitative.

The first step is to make clear what is meant by a **standard** or **unit.** The pupils should be instructed to measure the blackboard or the table by means of a stick or a piece of string of any length. The disadvantage of using *any* length becomes apparent when an attempt is made to communicate the result of the measurement to a second person. For example, suppose you tell me that the table is five and a half times as long as your piece of string; this means nothing to me until I know the length of your piece of string. Hence the need for a recognised standard.

Standard of Length. — Let every pupil be supplied with a piece of string or a lath a little more than a yard long. Mark off a yard exactly, either by tying a knot or by marking the string or wood with ink or crayon. Introduce this length as the English standard of linear measurement. Pass the string round your waist, and show that the yard is approximately the length required to **gird** this part of the body. Mention of the **span,** the **foot,** the **cubit** (length of arm from elbow to middle finger), the **fathom** (length of outstretched arms) will make this interesting point all the more apparent. The inch is the twelfth part of the foot, as may be seen from the derivation of the word from the Latin *uncia*, or twelfth part. The great difficulty in connection with these standards was their variation: for example, the foot of one man was likely to be quite different in length from the foot of another man. Hence arose the various standards, which are kept with the utmost care, and in strict agreement with which all legal weights and measures must be.

The standard yard is a bronze bar an inch thick, and having two gold plugs let in near to each end. Across these plugs are two scratches, and the distance from one scratch

to the other is just a yard, when the temperature of the bar is 62° F.

It should be mentioned that bodies expand when heated; hence the standard will be less than a yard long when the temperature is below 62° F., and more than a yard when the temperature is above 62° F.

Area.—The unit, or standard, of area is the square yard, which should be marked out on the floor of the room in order to show what space this unit covers; further, a square yard of paper should be placed on the wall in full view of the class, to the same end. A comparison should be made with the submultiples and multiples used in long measure; and it should be observed that for the largest areas, such as those of continents or countries, the square mile is the unit, whilst for smallest areas the square inch is used.

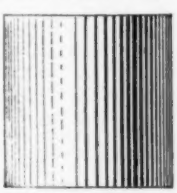
Volume.—The unit is the cubic foot. This, however, is often replaced by a smaller unit—namely, the gallon—which can best be remembered from the following old couplet:—

"A pint of cold water
Weighs a pound and a quarter;"

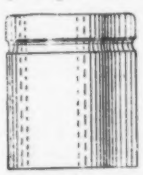
and hence a gallon, which contains eight pints, is the volume occupied by 10 lbs. of pure water at 62° F., the temperature being given for exactly the same reason as in the case of the standard yard.

A cubic foot of water weighs 62·3 lbs., or nearly 1,000 ounces, at 62° F.; hence it is 6·23 or about 6¼ times as much as the gallon. A pint of water should be weighed by each scholar in order to test the truth of the above statements; and a cubic foot should be constructed, into which should be poured as many gallons as are required to fill it. The formation of the multiples and submultiples of cubic measure should be compared with those of long and square measure; and especial care should be taken at this juncture to show the difference between lengths, areas, and volumes—that is, space in one, two, or three dimensions respectively.

Mass or Weight.—Iron and brass pound weights should be shown, and the picture of the standard platinum pound should be exhibited. In addition, the children should be asked how much water is needed to weigh a pound; which



Platinum cylinder: 1 kilogram.



Standard pound: Height, 1·35 inches. Diameter, 1·15 inches.

quantity should be served out to each child, who also should be allowed to weigh out a pound of clay. This should be carefully balanced on the hand, in order that a clear conception of what a pound really is may be arrived at.

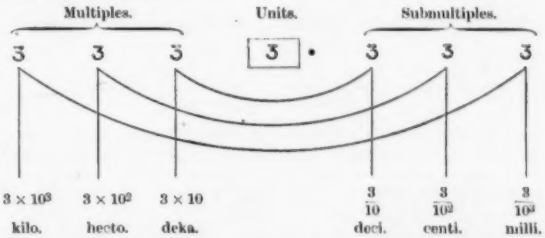
The method of forming the multiples and submultiples of these units should now be studied, and the absence of simplicity in the selection of these numbers should be remarked upon. Furthermore, now that the units of length, volume, and mass have been studied, attention should be drawn to the fact that there is no simple connection between the yard, the gallon, and the pound, and therefore that it is not easy to go from one unit to another. Such considerations as these lead naturally to the mention of the better system, in which these blemishes do not appear.

The Metric System.—It is not proposed here to go deeply into this, as most teachers will have discussed it in the ordinary course of their arithmetic lessons. Attention, therefore, will be merely directed to a few very important points that do not always get the consideration they merit.

Why **metric?** Because the metre (the ten-millionth part of the earth's meridional quadrant) is the unit of length, and because from the metre all the other units can readily be obtained as follows:—

Unit of Volume.—This is the **litre** or **cubic decimetre,** which is got by making a cube whose edge is the tenth part of a metre in length. Such a cubic decimetre can easily be made in cardboard. This exercise should be done by all; and if the corners can be so strengthened by glue as to enable the cubic decimetre or litre thus formed to hold water, it will be great gain, as *the weight of a litre of water at 4° C.* is the unit of mass or **kilogram.** This should be proved by counterpoising either the vessel made as above, or the tin cubic decimetre sold by instrument makers, and by showing that the water required to fill this vessel weighs just a kilogram.

The System is a Decimal One.—This is best shown by comparison with the expression of numbers in the ordinary way—that is, in the denary scale, as shown in the accompanying diagram.



The pupil will understand now why we speak of ·5 or ·03 grams, etc., and will also see the connection between the position value of numbers in the denary scale and the prefixes used in the metric system, which should be well learned as follows:—Milli = thousandth part, centi = hundredth part, deci = tenth part; deka = ten times, hecto = hundred times, kilo = thousand times. When once these prefixes have been learned as below, the whole of the metric system will have been mastered.

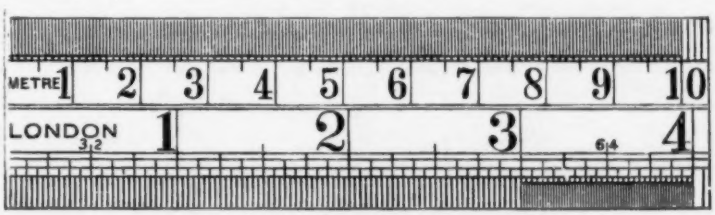
10 millis = 1 centi.	10 units = 1 deka.
10 centis = 1 deci.	10 dekas = 1 hecto.
10 decis = 1 unit.	10 hectos = 1 kilo.

Comparison of British and Metric Measures.

(To be posted up for reference.)

1 inch = 2·5 cm. (about).	1 c. ft. = 28316 c. cm.
1 ft. = 30·48 cm.	1 gal. = 4·54 li.
1 mm. = ·039 in.	1 c.c. = ·061 c. in.
1 cm. = ·3937 in.	1 cm. = 35·316 c. ft.
1 dm. = 3·937 in. (= nearly 4").	1 gm. = ·0353 oz.
1 m. = 39·37 in. (= 3′ 3·3").	1 kilo. = 35·27 oz. = 2·2 lbs.
1 sq. in. = 6·45 sq. cm.	1 lb. = 453·59 g.
1 sq. ft. = 929 sq. cm.	1 lit. = 1·761 pints.
1 c. in. = 16·39 c. cm.	

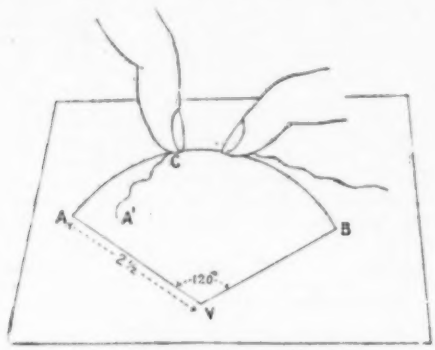
Exercises in Measurement of Length.—A scale divided into inches, and tenths, eighths, or sixteenths of an inch, and



A decimeter divided into 10 centimetres and 100 millimetres.

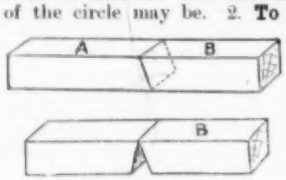
into decimetres, centimetres, and millimetres, should be provided or made. In measuring with this rule, the student should be taught to hold it vertically, and not to read from the end, because the end divisions are usually inaccurate. The exact length and breadth of a book, a slate, the desk, etc., should be ascertained by this method, after which curved lines should be introduced, and the scholar should be invited to suggest a means of measuring such lines. Two methods

should be well practised, namely:—1. **The cotton** or thread method, as shown in the accompanying sketch, which shows how to get a length of thread exactly equal to the length of the curve, and so by measuring the thread the length of the



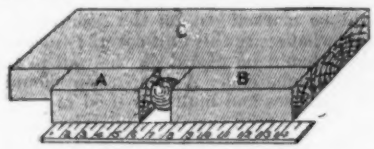
Measurement of a curved line.

curve is arrived at. The only caution to be observed is that but very small lengths of the curved line should be measured at the same time; the pupil should be expected to explain why. 2. **The wheel** method, which can be well represented by a halfpenny, scratched at the edge, and then very carefully rolled over the whole of the curve—a second scratch being made to mark the exact point on the circumference of the halfpenny where the curve ended, and the number of revolutions being very carefully noted. The halfpenny is next made to go through exactly the same number of revolutions as were required to measure the curve, this time over the rule, and the distance thus traversed will be the length of the curve. Every curve given for measurement should be measured by these two methods. Of course, a pill-box or other circular disc may be used in place of the halfpenny; but the coin is handiest, and is usually preferred. The pupil should be told that this measurement by wheeling is utilised in a very useful little measuring instrument, the **opisometer** or wheel-measure, a specimen of which, since it only costs about a shilling, should be provided for inspection. The circumference of the halfpenny may be easily and quickly measured in the following simple way:—A strip of paper is wrapped tightly round the edge of the coin, the two ends being made to overlap. A pin is passed through the paper where it is double—that is, at the overlap—and the paper is now removed and opened, and the distance between the two punctures made by the pin gives, when measured, the circumference of the halfpenny. Compare this with the measurement got by wheeling the coin, and remembering that the diameter of a halfpenny is exactly an inch, compare the result got with that calculated by using the ratio between diameter and circumference as obtained in our experiments given below. Endless interesting exercises in linear measurement may be given, but we can here only refer to two others, namely:—1. **To show the relation between the diameter and the circumference of a circle.** A circle is drawn; the diameter is obtained by the usual geometrical method, and is carefully measured. The circumference is then measured both by the thread and by the wheel method, and the one length is divided into the other. Circles of various sizes are experimented upon in order to show that the ratio is no chance one, but an invariable quotient of diameter into circumference, whatever the size of the circle may be. 2. **To find the diameter, and so the circumference, of a sphere.** A block



Rectangular blocks of wood.

of wood is to be sawn into halves in such way that the sawn ends are exactly at right angles to the sides. To prove that this is really the case, fit the sawn pieces together so that what was the top surface of one may now be the bottom, when there must be no such inaccuracy as is shown in the accompanying figure. Placing the sphere as in the diagram,



Measuring the diameter of a sphere.

the gap between the two blocks will now exactly correspond in length with the diameter of the sphere. All that remains, then, is to measure this gap either at the top or at the bottom, as is done in the figure. If the diameter is multiplied by the ratio obtained in the last exercise, this will give us the desired circumference.

All measurements should be made in both English and metric measures, and should be recorded in the laboratory books in parallel columns, by which means a very intimate acquaintance with the relation between the two systems will be got in the very best way.

A NEW AND SIMPLE METHOD OF PROVING QUESTIONS IN ARITHMETIC.

FOR TEACHERS AND STUDENTS.

Simple Practice.

Simple practice—such as, to find the cost of 345 articles at £3, 7s. 9d. each—is only another form of multiplication, which has been treated of already. Since fractional quantities, both vulgar and decimal, have now been discussed, it may be advisable to introduce here examples of questions in practice, or compound multiplication, in which fractions occur.

Example:—

$34\frac{3}{4}$ articles, at £2, 6s. 4d. each, cost £80, 10s. 1d. Since $\frac{3}{4}$ can easily be made a finite decimal, it is simplest to make $34\frac{3}{4}$ into 34·75, and the N.C. rem. is 10. From £2, 6s. 4d. the N.C. rem. is 6. Now, 10 × 6, or 60, leaves a final N.C. rem. of **5**; and from £80, 10s. 1d. the final N.C. rem. is also **5**. As before, the number of decimal places that have disappeared has to be observed.

If $34\frac{3}{4}$ be kept in that form, the N.C. rem. is $\frac{7}{4}$, since 34 leaves a N.C. rem. of 1, and 1 × 4 + 3 is equal to 7 for the numerator, and 4 becomes the denominator. Then $\frac{7}{4}$ × 6 (from £2, 6s. 4d.) gives $\frac{42}{4}$ and a final N.C. rem. of $\frac{9}{4}$. From the answer, £80, 10s. 1d., there is a N.C. rem. of 5 which equals $\frac{20}{4}$; and $\frac{20}{4}$ also yields a N.C. rem. of $\frac{9}{4}$.

As an example in which the fractions cannot be converted into finite decimals, we may take $4\frac{1}{3}$ articles at 12s. $5\frac{5}{7}$d. each, of which the answer is £2, 14s. $0\frac{9}{21}$d.

Now, from $4\frac{1}{3}$ and 12s. $5\frac{5}{7}$d. we get N.C. rems. of $\frac{2}{3}$ and $\frac{3}{7}$; and $\frac{2}{3} \times \frac{3}{7} = \frac{6}{21}$, which becomes the final N.C. rem.—that is, 6 of a N.C. rem. at the denomination of 21ths of a penny. Also, £2, 14s. $0\frac{9}{21}$d. gives a final N.C. rem. of $\frac{6}{21}$.

One more example may be shown under this head. $34\frac{2}{3}$ articles, at £2, 6s. 6d. each, amount to £80, 12s.

These three expressions have respectively N.C. rems. of $\frac{5}{3}$, 8d., and 6d., the denomination being *pence*. $\frac{5}{3} \times 8 = \frac{40}{3}$.

from which the final N.C. rem. is $\frac{7}{3}$. Also, $6 = \frac{18}{3}$, from which the final N.C. rem. is $\frac{7}{3}$.

Compound Practice.

Example :—

Find the cost of 3 cwt. 3 qrs. 14 lbs. at £1, 14s. 6d. per cwt. The answer is £6, 13s. 8¼d.

Combining the answer with the question, it may be tested in the following way :—

3 cwt. 3 qrs. 14 lbs. (reduced to lbs.) × £1, 14s. 6d.
= 112 lbs. × £6, 13s. 8¼d.

Using the N.C. rems. of these at *pounds* and *farthings*, we have—

5×6 and 2×4.

From these the final N.C. rem. is **8** in each case.

Additional Calculations.

Questions in *unitary method*, *proportion*, *interest*, etc., can also be tested by casting out the elevens. These all more or less involve multiplication and division; and what has already been stated will be sufficient to show the method of application of number-casting to such questions, so that further examples are unnecessary.

Principle of Number-Casting.

The principle upon which number-casting depends is a simple one. Broadly it may be stated that by combining the answer with the data of the question, in an arithmetical calculation, the parts of the question may be so arranged that there is an equation, or two equal quantities; and it is very apparent that if these equalities are each divided by the same number, the remainder must be the same in each case.

We now proceed to show this in detail, using a tabular form.

For *addition* it may be stated thus :—

Suppose the figures to be added are represented by

$$(11 \times x) + a,$$
$$(11 \times y) + b,$$
$$(11 \times z) + c,$$

and the sum by $\{11(x + y + z)\} + a + b + c$.

The three rows of the question, if divided each by 11, leave remainders of a, b, c, which, added together and divided by 11, equal $\frac{a+b+c}{11}$. Let the final remainder from $\frac{a+b+c}{11}$ be d.

It is evident that the sum divided by 11 also leaves the same remainder $d\left(=\frac{a+b+c}{11}\right)$.

For *multiplication*, the principle may be shown thus :—

The multiplicand × the multiplier = the product. Let this be represented by

$\{(11 \times x) + a\} \times \{(11 \times y) + b\} = (11^2xy) + \{11 \times (bx + ay)\} + ab$.

Dividing each side by 11—that is, casting out the elevens—the remainders are

$$\frac{a}{11} \times \frac{b}{11} = \frac{ab}{11},$$
$$\frac{ab}{11} = \frac{ab}{11},$$

from which there must be the same remainder in each case.

For *division with a remainder*, the principle may be shown thus :—

The divisor × the quotient = the dividend − the remainder. Let this be represented by

$(11x + a)(11y + b) = [(11^2xy) + \{11(bx + ay)\} + ab + c] - c$.

Dividing each side by 11 and retaining the remainders, we get

$$\frac{ab}{11} = \frac{ab + c}{11} - \frac{c}{11}.$$

Suppose $\frac{ab}{11} = d$, and $\frac{c}{11} = f$, and this becomes

$$d = d + f - f,$$
$$\therefore d = d.$$

Use of other Numbers instead of Eleven.

The principle of number-casting explained above shows that other numbers may be used for the purpose instead of eleven. This number has, however, been selected, as objections inherent in other numbers do not apply to it. It is also, owing to the device for avoiding *direct* division by 11 in order to find a remainder, the easiest of application, next to the number nine. No other number besides eleven can be recommended for use unless as a *second* test in some cases, and 9 or 7 might perhaps be employed then.

(*To be continued.*)

ELEMENTARY LESSONS IN THE PRINCIPLES OF GRAMMAR.

A Course of Forty Oral Lessons for the First Year (New Code, Standard IV.).

BY JOHN R. TIMSON, B.A.

LESSON XXI.

PARSING OF THE VERB.

We will consider the verb, and parse it as far as we can. The verb is a word by which a speaker makes an assertion concerning something which we call the subject of the assertion.

The verb is of the same number and person as the subject, and is said to agree with it.

Hence our first step in parsing the verb is to state this.

Tom is a boy.

Is.....Verb, singular number, third person, agreeing with "Tom."

We are happy.

Are ...Verb, plural number, first person, agreeing with "we."

Verbs also indicate time. We will now simply state whether the verb is present, past, or future tense.

They were good.

Were...Verb, past tense, plural number, third person, agreeing with "they."

We may next name the kinds of verbs. The verb "to be" stands alone as the verb by which a speaker indicates that he is making an assertion without stating the assertion itself; for example,—

The boy is naughty.

Naughty—The assertion made about the boy.

Most other verbs assert some action, and are of two classes—

1. Transitive, when the action passes to an object.
2. Intransitive, when the action begins and ends with the subject.

We shall not use the words "transitive" and "intransitive" in parsing the verb "to be."

He is good.

Is.....Verb, present tense, singular number, third person, agreeing with "he."

Tom plays.

Plays.....Intransitive verb, present tense, singular number, third person, agreeing with "Tom."

The girls stroked the cat.

Stroked...Transitive verb, past tense, plural number, third person, agreeing with "girls."

In the future tense the verb "shall" is used in the first person, and "wilt" or "will" in the second and third person. We parse "shall" or "will" as an auxiliary verb of the future tense.

Thou wilt be industrious.

Wilt.....Auxiliary verb of the future tense.

Wilt be...Verb, future tense, singular number, second person, agreeing with "thou."

We must remember that although "you" is used for single persons, yet it is strictly plural, and requires the plural form of the verb.

"You" has come into use instead of "thou," as a mark of respect to the person addressed. "You" addressed to single persons once meant, "I consider you of more importance than a single person, and therefore I address you with the plural pronoun."

"You" must always be parsed as plural number—
You will go.

You.....Personal pronoun, common gender, plural number, second person, nominative case to "will go."
Will.....Auxiliary verb of the future tense.
Will go...Intransitive verb, future tense, plural number, second person, agreeing with "you."

There remains much more to be considered in parsing verbs fully, but what has been given requires much practice first.

MEMORY NOTES.

Parsing of a Verb.

1. Kind—(*a*) Transitive verb.
(*b*) Intransitive verb.
2. Present, past, or future tense.
3. Singular or plural number; first, second, or third person; agreeing with the subject.

LESSON XXII.

INTERROGATIONS.

If a person desires information, he asks a question. We are now going to consider several ways of asking questions. In asking a question, a speaker invites the hearer to make an assertion; for example,—

"Is the man a rogue?"

The hearer may reply,—

"Yes, the man is a rogue."

Now notice that in the question the verb "is" is placed first.

Question—Is butter good?
Answer—Butter is good.

The first method of asking a question is by putting the verb first—

Has Tom a watch?
Were you at school?

You should now practise asking questions in this way with the present and past tenses of the verb "to be" and "to have," also with the verbs "shall," "will," "may," "can," "ought," and "must."

To every question give the full answer, and note the change of position of the verb. If you answer "Yes," your reply is an *affirmation*, and the answer "No" is a *negation* or denial.

The speaker of the question becomes the hearer of the answer, and the hearer of the question becomes the speaker of the answer. For this reason, a pronoun of the first person in the question must be changed for a pronoun of the second person in the answer, and the second person in the question for the first person in the answer. For example,—

Question—Am *I* right?
Answer—*You* are right.
Question—Are *you* ready?
Answer—*I* am ready.

To afford practice in the use of language you should answer questions in full. Try to use all the words in the question, being careful to change the pronouns.

When a speaker asks his hearer to assert or deny an action in the present tense, he asks the question with the word "do," and in the past tense with the word "did." For example,—

Question—Do you like cherries?
Answer—I like cherries.
Question—Did you go?
Answer—Yes, I went.

"Do" and "did" are auxiliary verbs of interrogation. They should be omitted in the answer unless the reply is negative.

In affirmative statements, "do" and "did" mark emphasis or strength of assertion, often to oppose contradiction—for example, I say you *did* write the letter. But in negative assertions "do" and "did" must be used—for example, Did you go? No, I *did* not go.

In all tenses except the present and the past, questions are asked by placing the auxiliary verbs first. For example,—

Shall I speak?
Have I spoken?

You are now able to conjugate a verb interrogatively in the nine primary tenses, and you should practise doing so with several verbs.

Simple Tenses—*Present*...Do I write?
Past.....Did I write?
Future...Shall I write?
Perfect Tenses—*Present*...Have I written?
Past.....Had I written?
Future...Shall I have written?
Imperfect Tenses—*Present*...Am I writing?
Past.....Was I writing?
Future...Shall I be writing?

If a speaker desires to know the subject, he opens the question with "who" or "what." For example,—

Who broke the window?
Tom broke the window.

"Who" and "Tom" mean one and the same person. "Who" is nominative case to "broke."

In asking for an object the speaker uses "whom" or "what."

Whom has he struck?
He has struck Tom.

"Whom" and "Tom" mean the same person. "Whom" is objective case, governed by "has struck."

"Whose" is used to ask for a possessor—

Whose cap is it?
It is Tom's cap.

"Whose" and "Tom's" mean the same person. "Whose" is possessive case, depending on "cap."

"Who," "what," "whom," "whose" are called *Interrogative Pronouns*. "Who," "whom," "whose" are used for persons, "what" for things.

MEMORY NOTES.

A question invites a hearer to make an assertion.

In asking questions with the present and past of the verbs "to be" and "to have," the verb is placed first—for example, Is he here?

The verbs "will," "would," "can," "could," "may," "might," "shall," "should," "ought," and "must" are also placed first in questions—for example, Ought he to write?

"Do" and "did" are used to ask questions with the present and past tenses of other verbs—for example, Do you know?

Do.....Auxiliary verb of interrogation.

In affirmative statements "do" expresses emphasis—for example, I *do* know.

Do.....Auxiliary verb of emphasis.

In negative statements "do" is used—for example, I *do* not know.

Do.....Auxiliary verb of negation.

In tenses requiring an auxiliary verb, a question is asked by putting the auxiliary verb first; for example,—

Have I written?
Am I writing?

The interrogative pronouns "who," "whom," "whose," "what" are also used to ask questions.

"Who" is nominative case.
"Whom" is objective case.
"Whose" is possessive case.
"What" is either nominative or objective case.
"Who," "whom," "whose" are used for persons, and "what" for things.

(To be continued.)

HOW TO TEACH WRITING.

BY JOHN T. PEARCE, B.A.

PART II.

CONSIDER, again, how much can be taught from an

combination. Notice that it is not altered by inversion, and let us enumerate what the child should be taught to see from this.

1. Verticality, not—

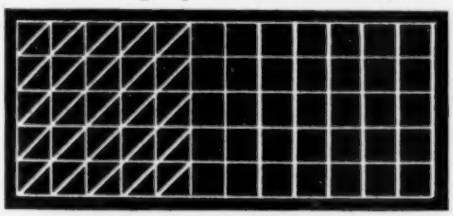
2. Parallelism, not—

3. Loop equality, not—

4. Curve similarity, not—

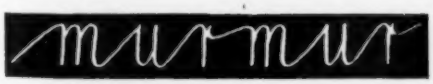
Arithmetic pass books and squared drawing copies can be put to most effective uses, but in teaching both the verticals and the

obliques more than single squares should be utilised, thus—



Nothing is more calculated to give the learner the requisite manual dexterity than exercises of this nature. After a dictation lesson, too, the teacher should not be above passing out rulers in order to make a proper test of the writing. A child knows that no ruler can lie along a curve; hence the glaring errors apparent in

are non-existent in



It is not a bad idea, either, to give a class to understand that the writing they learn possesses many of the most excellent features. By writing on the board, for instance,—

it becomes clear at once that No. 1 is the most legible, the neatest, the least cramped, the easiest, etc.

We all know that the successful teacher is he who adroitly dovetails his lessons. He who can so blend his subjects as to render them almost a unity is met half-way by success. For example, is it not very like firing two simultaneous shots to get a pupil to write an essay on, say—

1. Civil Service Writing;
2. Common Errors in Penmanship; or—
3. Writing Wrinkles?

In any case, we are confident that these subjects teach as much composition as the ordinary and hackneyed—

1. Sunday-school Trip; or—
2. Walk in the Country.

The fact is, for years back writing has been treated almost exclusively as an art; but there is a science in it, and the rate at which the art result is reached depends principally on the amount of science known. Make the science simple, and the art is easily acquired.

A child, for example, comes to a proper understanding of the 45° oblique when he learns that the distance AB is equal to AC—

And not only so, but he sees that each letter ought to be equidistant from its neighbour, as shown. Why burden the poor learner's memory with countless rules about heights and distances? Tell him to make every long letter the same length, and to make the part above the line equal to the part below the line, thus—

This saves endless worry, and effectively eliminates all necessity for fancifully-ruled copy books—German and otherwise. Above the second standard, writing copies should have single lines only, and below it never more than two. Some teachers of our acquaintance use unruled paper for classes above the fifth. It is a great mistake to teach the elements to the lower classes only. Even Standard VII. thoroughly enjoys a good lesson on verticals, obliques, loops, and turns; and it is a positive treat to watch how anxiously any class whatever interests itself as a word is written with *similar colours for similar strokes*.

Space does not permit us to adapt any of these ideas to the current civil service hand; we leave that to practical teachers. In closing, however, we may be allowed to add that perhaps one of the best rules to be observed in the teaching of any style is, "Know it exactly, teach it exactly, and set it exactly." It is not enough to give a "state" writing lesson perhaps twice a week. Expect good writing throughout, have it during the dictation, see that it appears in the home work, and on no account allow a child to write badly on a slate.

THE INSPECTOR'S NOTEBOOK.

BY AN INSPECTOR OF SCHOOLS.

THE CLASS SUBJECTS: GEOGRAPHY.

The Geography of the Upper Standards. Before proceeding to consider the methods of teaching another subject, we must deal generally with the geography of the upper standards. Prominence should be given to two points:—

1. Development of the reasoning powers by logical and exhaustive treatment of such topics as climate and productions.
2. Awakening the interest of the child in current events by spending a fair amount of time in what is commonly called newspaper geography.

Geography lends itself very much to inductive teaching. We often do not present to our children a sufficient number of individual examples. To teach geography by countries is scientifically wrong. Fancy learning one month that the climate of Denmark is damp, in the next month proceeding to the climate of Russia, and then returning to Holland during the third month, say! That won't pay. You must treat of climate as a whole; and although, according to the Code, a knowledge of the circumstances affecting climate is not required until the sixth standard is reached, yet it would be a distinct advantage to deal with this gradually from the fourth standard. I may illustrate. It is much more interesting to the scholars, as well as more intelligent on the part of the teacher of Standard IV., to deal with the reasons why Ireland has a damp and even climate, and to illustrate by reference to England, Scotland, Holland, Denmark, New Zealand, etc.—this, I say, is much to be preferred to merely telling the scholar that, as a matter of fact, these countries have an insular climate.

Then, in taking Canada in the same standard, it appears to me it is worth while, in dealing with the varying climates there found, to get behind the facts to the causes. This having been done, there is a foundation to be built upon in Standards V., VI., and VII. The productions should, of course, be treated along with the climate. A general lesson or two will be needed again here to demonstrate the dependence of the productions upon the climate.

Take Ireland as an example.

The scholars are shown that it is a small country surrounded by the sea, having a mass of land lying near it on the east, and the ocean on the other sides.

The sea causes the climate to be an even one, and, together with the prevailing south-west wind, causes much rain to fall.

This rain makes the grass grow, and prevents wheat from being grown to perfection. (Manitoba, the wheat-growing country, has a dry climate.) The pasture-land that prevails induces the farmer to rear cattle.

Consequently the chief exports are dairy produce and cattle.

* * * * * *

Standard V. Course. The course for Standard V. is Europe. This is a big order, but of course the teacher will have to pick her way, as it were. She will have to decide what to teach and what not to teach. Often too many details are attempted.

Europe is set for the Certificate Examination, for pupil teachers of the second year, and for Standard V. in day schools.

A moment's thought, therefore, will show that something very general and elementary must be expected from children of eleven years of age. Some teachers begin with countries, and end up finally with a disjointed knowledge of the whole. Others more logically begin with some general lessons upon the continent as a whole. You should first locate Europe on the map of the world, and for the first few lessons have that map before the class, together with the map of Europe. Even when dealing with each country, you should generally have the map of Europe by you. Only a warped notion of a country can be got from a map which shows that country alone. When you come to the detail, you should get a good set of roller wall-maps. The advantage of such maps as these is that only important details are indicated, and these are clearly seen. Again, they cannot be easily lost, and are at once available, all the maps of one particular course forming one roll.

* * * * * *

Standard VI. Course. For Standard VI. the Code lays down a wide syllabus. Here, again, the capability of the teacher is shown in avoiding details and laying stress upon principles and important facts. "The British colonies and dependencies. Interchange of productions. Circumstances which determine climate." Evidently it is intended that great stress is to be laid upon the climate and productions of the colonies. I should teach these from a good map of the world showing the British possessions in some distinctive colour—red, I believe, being generally preferred. Then, if you have a set of modern maps on a roll, as indicated for Standard V., you will be well equipped. Before taking the important detail of any one possession, plenty of time should be given to general teaching embracing the whole. The chief trade routes can be worked in. In this standard you get a favourable opportunity of dealing with the newspaper geography. For instance, in most schools one should now find a good war map fixed up. The places named during the war from day to day should be pointed out. Much commonsense instruction may be thus given in a casual way. In some schools the lantern is used to illustrate this subject. In a large school there is often one room which can easily be sufficiently darkened to allow of the use of the lantern. Without actually confining attention to what goes by the name of commercial geography, much can be done by giving prominence to trade in the ordinary geography lessons. It is highly important that first-class geographical readers should be in use in the upper standards.

* * * * * *

The Small School Scheme. In many schools, unfortunately, there are so few children in Standards VI. and VII. that these are taught geography with Standard V. Care must be taken to arrange for different courses in successive years. In small schools the course is, "Outlines of the world, with special knowledge of the British Empire and the chief products of the various colonies."

Teachers who take this scheme would do well to divide it up into three sections to make a three years' course. In so doing I think it would be wise to take the map of the world for the foundation in each year, and to give prominence to one part in addition. The scholars should each have an atlas.

* * * * * *

Concluding Remarks. In the lower standards, at least ninety minutes per week should be given to geography. In the upper standards, rather more time than this is wanted—one lesson being devoted to mapping.

There is no objection to calling geography your *first* class subject; only, if you do, you must be prepared to show that in the first three standards it is taught by means of object lessons. This subject can be dealt with in that form better than, say, English; but it appears to me it is advisable to take object lessons pure and simple as the first class subject, followed by elementary science in IV., V., and VI., thus treating geography in the normal way.

Mr. Henry Frowde announces that a large type edition, in crown octavo, of Dr. Moore's Oxford text of the *Divina Commedia* will be published at once at the Clarendon Press. It will contain a few emendations and corrections, and a revised index of proper names, by Mr. Paget Toynbee. A volume of Notes by the Rev. H. F. Tozer is in preparation, and should be in the hands of Dante students in little more than a year and a half from the present time.

Algebraic Factors for Pupil Teachers and Scholarship Students. By E. Ruse. (Ralph Holland and Co.) The two pages of formulæ and typical factors here given comprise some of the most useful results in a very important branch of algebra. They should be committed to memory by all young students.

OUR ILLUSTRATED GEOGRAPHICAL NOTEBOOK.

NEWFOUNDLAND—THE "FRENCH SHORE."

NEWFOUNDLAND has an area equal to that of England, and is not a possession to be lightly despised. Probably in the near future she will throw in her lot with the Canadian Union, when she will perhaps cease to suffer "from the want of stronger backing than her own," and be able "to carry out the public works necessary for the development of her remarkable territory." The Marquis of Lorne says we are not to think of this country as "a bare littoral, swept by glacial seas, and inhabited only by a few fishermen. Nothing can be further from the truth. To be sure, she does smell of fish; and a very good thing this is for her. But in the years to come she will have great mining communities, for copper, iron, lead, silver, and coal are all stored in good quantity beneath her soil."

We do not propose at present to discuss these favourable prospects of Newfoundland, but to draw attention to an old-standing evil that has long hampered the progress of the islanders.

The colony is indubitably the oldest of the British possessions; yet to all intents and purposes, by the treaty of Utrecht of 1713, the French remain masters of 700 miles of coast for the purpose of catching and drying fish. The terms of the treaty forbade the French to erect any buildings along the western coast other than stages made of boards, and huts requisite and necessary for drying fish. Fifty years later the islands of Miquelon and St. Pierre were ceded to France as shelters for French fishermen. No buildings, however, were to be erected thereon except for the purpose of the fishery, nor were the French to winter in the islands.

The treaty of Paris of 1814 confirmed previous arrangements, but Sir Charles Dilke points out that "to judge by the whole of the language employed in the negotiations and declarations, no kind of fishery was contemplated except cod fishing, and cod were intended by the word 'fish.' The word 'fish' in Newfoundland in the present day means cod." Notwithstanding this, in 1886 French fishermen commenced fishing for lobsters, and two years later erected factories for the purpose of canning lobsters, which, the British maintain, is contrary to the treaty.

The position at present is almost intolerable. The French claim the exclusive right of fishing off the western shore and *deny the right of the Newfoundlanders to make either fishing, agricultural, or mining settlements there.*

Little wonder that scarcely a fishing season passes without friction and unpleasantness between the colonists and their French rivals. By the terms of the treaties the French clearly possess certain rights. Whether they possess rights to the complete exclusion of the natives is a matter on which the latter hold very decided opinions. It is a great pity the French rights cannot be bought outright, or that we cannot allow them full rights of occupation in certain well-defined spots, such as they hold in India at Pondicherry. The former plan would be far preferable, but even the alternative would remove a serious obstacle to the progress and well-being of a large portion of the island.

In the accompanying sketch-map, the dotted coast-line shows the extent of the "French shore," which reaches from Cape St. John to Port au Basques.

A NEW ROUTE TO INDIA.

LONDON TO KARACHI IN SEVEN DAYS.

What the early years of the next century may see in the shape of railway expansions it is impossible to forecast. From the Cape to Cairo by rail was an attractive idea from the commencement, and though recent events in South Africa have tended to obscure and hinder the project, it will doubtless be carried through. The Great Siberian Railway has not entirely monopolised Russian railway enterprise, and in Russian Central Asia railway building has been steadily progressing for years.

The line at Merv has recently been extended to Kushk, on the borders of Afghanistan, and this point is only 438 miles from Chaiman, the nearest point of the Indian railways. Were a junction effected between these two points, it would be possible to travel from London to Karachi in a week, by rail the whole distance, except for crossing the Strait of Dover and the Caspian Sea.

To bring the resources of our great Indian Empire within a week of Europe and the mother country would have far-reaching effects, the possibilities of which we can scarcely grasp. Political considerations may prevent the furtherance of the project for a time; but the value of speedier communication with India, and with the south of Asia generally, is so self-evident that ways and means will certainly be found to consummate so desirable a scheme.

OUR COLONIAL RAILWAYS.

The following statistics are reproduced from the *Colonial Abstract* recently issued. The figures are sufficiently explanatory in themselves, and show how largely railways enter into the growth and expansion of the British Empire.

RAILWAYS OPEN IN VARIOUS BRITISH COLONIES IN 1888 AND 1898.

	1888. Miles.	1898. Miles.
India	15,186	21,887
Ceylon	181	297
New South Wales	2,198	2,775
Victoria	2,018	3,113
South Australia	1,500	1,744
North Australia	—	146
West Australia	234	1,487
Tasmania	328	509
Cape Colony	1,776	2,357
Canada	12,628	16,718
Newfoundland	112	638
Jamaica	64	185
	36,225	51,856

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OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Head-Master of the Belvedere Pupil Teachers' Centre, First on Scholarship List, Author of "Scholarship School Management."

SPRING EXAMINATION, 1900.

Eleventh Month—February.

WORK TO BE PREPARED.

1. READING AND REPETITION.

REGULAR practice in both subjects is essential. Reading should not be limited to the prescribed books. Endeavour to read some useful book on general topics each month.

2. ENGLISH.

Candidates.—*Marmion*, Canto vi., lines 1022 to the end.
First Year.—*The Traveller*, lines 412 to the end. Twenty roots and meanings each week. Derivation of all important words in the passage set.
Second Year.—*Julius Cæsar*, Act v., Scene 4 to the end. Common mistakes in written and spoken language. (See *Pupil Teachers' English Notebook.*)

3. ESSAYS.

Write one or two essays each week, selecting from the following:—Coal and its Uses; The Life of the Author of the Poem you have been studying; The Advantages of Travelling; "A stitch in time saves nine;" Success, and how it is attained; Our Army and Navy; Spring and Autumn contrasted; Winter Pastimes.

4. HISTORY.

Candidates.—George IV., William IV., and Victoria.
First Year.—Edward VI., Mary, and Elizabeth.
Second Year.—Victoria.

5. GEOGRAPHY.

Candidates.—Ireland: industries, towns, people, etc.
First Year.—Finish India.
Second Year.—Finish Australia; New Zealand.

6. ARITHMETIC.

General practice. Work any back questions. Give particular attention to theory and method.

7. EUCLID.

First Year.—Revise Props. 11–20, with six deductions each week.
Second Year.—Revise Props. 27–40, with eight deductions each week.

8. ALGEBRA AND MUSIC.

General revision, and regular practice with back questions.

Notes on the Month's Work.

1. ENGLISH.

(*a*) "MARMION."

Parsing and Analysis.

Line 1022. *But.* Conj. Advers., joining preceding sentence to line 1023.
1023. *Desperate.* Adjectival completion of *grew*; sometimes called the Proleptic Adjective. It expresses the result of the action, and must *not* be taken as an Adverb of Manner.
1025. *Horse.* Collective Noun.
1026. *Front*, *flank*, and *rear.* May be taken as Adverbs of Place, or if a Preposition is supplied, Abstract Nouns.
1029. Read, "*Though the shafts fall as thick as snow falls.*"
1033. *Good.* See line 1023.
1035. *Each.* Distributive Adj., qual. *spearmen.*
1036. *Instant.* Adverbial Object.
1038. *Linked.* Perf. Pass. Part., qual. *groom* and *squire.*
1047. *King, lords, mightiest.* Nominatives Absolute. Supply *being* before *low.*
1054. *Many a.* Note the difference between "many bands" and "many a band." The former might imply that many bands crossed together; the latter implies that the action was repeated time after time.
1061. *Age.* Adverbial Object.
1068. *Pride.* Abstract Noun. The Nouns in succeeding line are in apposition.
1071–8. "I do not doubt that that corpse, although it is disfigured so as to be unrecognisable, is really that of your king; do not look north to Norham Castle, upbraiding the lady who was to some extent responsible for this disaster; and do not entertain the hope that your king escaped from the battlefield and is travelling abroad, and that he will in due time return."
1082. *Well.* Adv., mod. *beseemed* (line 1084).
1085. *Changed*—that is, the monarch. *Since*, Preposition, gov. *night.*
1086. *Me* = *myself.* Reflexive Pronoun.
1093. *Image.* Objective Case.
1097. *Thanks.* Nom. to *be* understood.
1098. *The spoiler had a meet guerdon.*
1099. *Erst* = *formerly.* Adv. of Time, mod. *was found.*
1100. *Feet* and *hands.* Nominatives Absolute.
1102. *All.* Adv., mod. *around.*
1110. *One.* Pronoun, in apposition with *swain.*
1112. *Sore*—that is, *sorely.*
1114. *Close.* Adv., mod. *by....side.*
1119. *Less.* Adv. of Degree, mod. *easy.* *Were*, Subj. Mood.
1121. *Even.* Adv. of Emphasis, mod. the Adv. Sent. *where he lay.*
1126. *From out.* Comp. Preposition.
1133. *Them* for *themselves.* Reflexive Pronoun.
1143. *To speak*, etc. Obj. of *dread.*
1157. *Faith*—that is, *fealty* or *honour.* Nom. Absolute. *Plain*, Proleptic Adj. (See line 1023.)
1164. Object of *did agree.*
1172. *It.* Impersonal Pronoun. *To say*, etc., in apposition, enlargement of *it.*
1177. Scott here supposes that he is a minstrel reciting the tale to a collection of lords and ladies, as the old harper did in *The Lay of the Last Minstrel.* The same mistake is made in stanza v., line 148.
1178. *Listed* for *listened.* Very unusual form.
1179. *May deign.* Subj. Mood.
1181. Supply *I wish* at commencement of line. So also in lines 1183, 1189, 1190, 1193, 1194, 1195.
1184. *Best.* Adv. of Degree, mod. *loves.* *The* is redundant.
1186. *But* = *except.*
1187. *Too* = *also.* Adv., mod. *wish.*

(*b*) "THE TRAVELLER."

General Paraphrase (concluded).

Line 413. Perhaps even while I am writing, some poor emigrant is painfully making his way through the trackless labyrinth of woods, equally afraid of the attacks of wild beasts on the one hand and the murderous onslaught of the lurking savage on the other. Terrified by the roaring whirlwind above and the cries of the animals crouching around, afraid to stop in such a perilous position, and too weak and weary to proceed, the poor exile casts many a longing look to the far east, and recalls with grief his former happy and prosperous life in England.

Line 423. I set out at the beginning of my verse to find "some spot to real happiness consigned," but my search has been useless and futile, or rather, I have been endeavouring to discover under different governments what exists under all; for we are forced to conclude that happiness depends mainly upon the mind, and not upon external circumstances. The character of the supreme authority in any state may be tyrannical, laws may bear heavily upon the inhabitants, but this affects the happiness of the people to a very small extent. It is impossible to make people happy by legislation, and the opposite is equally true. We create our own happiness by our thoughts, our conduct, and our associates. Political convulsions rarely disturb the quiet serenity of home life. Trouble, imprisonment, torture, and death befall those only who take a prominent part in political strife; the private individual, by reason of his insignificance, retains his thoughts, beliefs, and happiness undisturbed.

(*N.B.*—Goldsmith's picture of the emigrant to America is very incorrect. It is to be doubted whether many of them would have returned if they had had the opportunity.)

Parsing and Analysis.

Line 413. *Even.* Adv. of Emphasis, mod. *now.*
Even now perhaps. Modifies *casts* in line 421.
417. *Above.* Adv. of Place, mod. *flies.*
418. *All.* Adv., mod. *around.*
420. *Fearful.* Adj., qual. *exile.* *To stop*, Infinitive, mod. *fearful.*
Faint. Adj., qual. *exile.* *To go*, Infinitive, mod. *faint.*
422. *His bosom* (*to*) *sympathise with mine.* Object of *bids.*
Mine. Possessive Pronoun, Obj. Case.
423. *To find.* Infinitive, limiting *search.*
424. *Only.* Adj., qual. *mind.* The word is probably misplaced.

426. Supply *which* after *good*.
427. The Principal Sentence is, *In every government how small is that part of all.*
431. *Still.* Adv. of Time. *Consigned,* Perfect Participle, qual. *we.*
435. *Axe, wheel, crown, bed.* Nominatives to *leave.*
437. *But.* Adv., mod. *rarely.*

(c) "JULIUS CÆSAR," *Act v., Scene 4.*

Line 12. *Only I yield to die*—that is, *I yield only on condition that you put me to death.*
13. *Straight.* Adv., mod. *kill.*
20. *Enough.* Adv. of Degree, mod. *safe.*
21. *Dare.* Principal Verb. Object = *(to) assure thee.... Brutus.*
29. Read, *(to be) my friends than (to be) mine enemies.*
32. Adj. Sentence to *word.*

Scene 5.

6. The necessary words must be supplied in this disjointed form of conversation to analyse and parse—for example, *What! (shall) I (kill thee), my lord? No, (I would) not (kill thee) for all the world. (Hold thy) peace then. (Say) no words,* etc.
14. *Even.* Adv. of Emphasis, mod. *at his eyes.*
19. *Night.* Adverbial Object.
24. *To leap....push us.* Enlargement of *it.*
Ourselves. Nom. Absolute.
27. *Even.* Adv. of Emphasis, mod. following phrase.
Prithee. Analyse and parse as *pray thee*—that is, *I pray thee.*
30. *Tarrying.* Verbal Noun, Nom. to *is.*
32. *While.* Abstract Noun. Adverbial Object.
46. *Only.* Adj., lim. *Brutus.*
47. *Else.* Adj., lim. *man.*
69. *Save only he*—that is, *he only being saved* (or *excepted*). *He,* Nom. Absolute. *Save,* Perfect Participle. It would be well in parsing to add a note on the peculiarity of this word.
80. That is, *let us (to go) away,* etc.

As these two scenes are short, and will hardly occupy a month in preparation, students should start revising, paying more attention to the play as literature. "To attain the standard of perfect possession," the reader ought to have an intimate and ready knowledge of the following parts of the subject:—

1. The plot and story of the play.
   (*a*) The general plot.
   (*b*) The special incidents.
2. The characters.
3. The influence and interplay of the characters upon each other.
4. Complete possession of the language (meanings, use of old words, grammar, etc.).
5. Power to reproduce and quote.
6. Power to locate—that is, to attribute a line or statement to a certain person upon a certain occasion, etc.

All these points are dealt with in the edition (Moffatt's) recommended as a text-book. A typical examination paper is given below.

3. ESSAYS.

Great care must be taken in planning the essays. A skeleton draft must always be made. Specimens should be sent up for criticism, which is the most useful form of assistance.

4. HISTORY.

Candidates.—Chief Points:—

George the Fourth. Cato Street Conspiracy. Insurrection. Freedom of Greece. Battle of Navarino. Catholic Emancipation (note the various laws that had been passed against Catholics—for example, Test, Corporation, etc.).

William the Fourth. The Reform Bill (*most* important), and proceedings of the Reformed Parliament.

Victoria. The Chartists. Penny Postage. Repeal of the Corn Laws. Exhibition. Crimean War. Mutiny in India. Acquisition of colonies. Advances made in all branches of manufacture, inventions, education, etc.

First Year.—Chief Points:—

Edward the Sixth. The Reformation. The social condition and discontent. Lady Jane Grey.

Mary. Marriage with Philip. Wyatt's Revolt. Marian persecution. War with France.

Elizabeth. Difficulties at accession, and how surmounted. Settlement of religious differences at home. Mary Queen of Scots, and plots connected with her. Foreign policy: France and Spain conciliated during the early years; afterwards, France prevented from interfering in English affairs by help given to the Huguenots, Spain by assistance to the Netherlands. Note increase in the prosperity of the nation; the early voyagers—"Sea-dogs" Drake, Hawkins, etc. The Armada: its causes and results. The Irish Rebellion. The Poor Laws.

Second Year.—See above.

5. GEOGRAPHY.

First Year.—The government of India must be carefully studied—(*a*) the India Office in England; (*b*) in India. (1) The Viceroy and his Council; (2) the thirteen Provinces; (3) the subdivision into Districts; (4) the Native States. Note also the improvements in the country since English occupation: roads, railways, lighthouses, harbours, telegraph and postal arrangements, canals, irrigation works, development of industries—for example, tea, cotton, jute, etc.

Second Year.—The government of the Australian colonies should be noted, and the proposal for federation on the lines of the Dominion of Canada. Something should be known of the aborigines of Australia and the Maoris of New Zealand. The industries are also important.

Test Questions.

1. *English.—Candidates.*—(Answer Question 1 and *two* others.)
(1.) Analyse the following:—

"Lord Marmion started from the ground,
As light as if he felt *no* wound;
Though in the action burst the tide
In torrents from his wounded side.
'*Then it* was truth!' he said."

(2.) Parse the words in italics.
(3.) Give the meaning of *bartisan, leaguer, paladin, rowel, portcullis, targe,* and *palfrey.*
(4.) Explain:—

"And in the chief three mullets stood."
"Flodden had been Bannockburn."
"To moated Lichfield's lofty pile."
"My basnet to a prentice cap,
Lord Surrey's o'er the Till!"
"By Archibald won in bloody work,
Against the Saracen and Turk."

(5.) Define nominative case, infinitive mood, passive voice, and give illustrations from the poem.

First Year.—(Answer Question 1 and *two* others.)
(1.) Analyse the following, and parse words in italics:—

"*Still* may thy blooms the changeful clime endure!
I *only would* repress them *to secure;*
For just experience tells, in every soil,
That those who think must govern those who toil."

(2.) Give in your own words Goldsmith's estimate of the French character.
(3.) Explain the force of the prefixes in the following, and give two other examples of each: *represt, transmit, disproportioned, depopulation, submissive, procession, sympathetic, extols.*
(4.) Write a brief life of Goldsmith, and say something of the writers who were contemporary with him.
(5.) Define the various kinds of sentence, and give one illustration of each from *The Traveller.*

Second Year.—(Answer Question 1 and *two* others.)
(1.) Analyse the following, and parse the words in italics:—

"But *'tis* a common proof
That lowliness is young ambition's ladder,
Whereto the climber-upward turns his face;
But when he *once* attains the upmost round,
He then unto the ladder turns his back,
Looks in the clouds, scorning the base degrees
By which he did ascend."

(2.) Explain the following:—"I have some aim;" "the posture of your blows;" "orts and imitations;" "men cautelous;" "set our battles on."
(3.) By whom, to whom, and on what occasions were the following lines uttered?—
(*a*) "This was the noblest Roman of them all."
(*b*) "The last of all the Romans."
(*c*) "In Parthia did I take thee prisoner."
(*d*) "I trouble thee too much, but thou art willing."
(*e*) "Oh! he sits high in all the people's hearts."
(*f*) "I know where I will wear this dagger, then."
(4.) Write a character of Cassius or Brutus, illustrating your statements by quotations.
(5.) Give examples of any words used in the play differently from modern usage, and of any peculiarities of grammar.

2. *History.—Candidates.*
(1.) Say what you can of the Seven Years' War.
(2.) What caused the revolt of the American colonies?
(3.) Describe the battle of Waterloo or the battle of Trafalgar.

First Year.
(1.) Write a life and character of Cardinal Wolsey.
(2.) Give an account of the dissolution of the monasteries. Why did the common people feel discontented at the action?
(3.) What led to the battle of Flodden? Describe it.

Second Year.
(1.) Describe, with a plan, the battle of Waterloo.

(2.) Give some account of the Peninsular War.
(3.) What was the Catholic Emancipation Bill? Why was it necessary?

3. *Geography.—Candidates.*—Describe the mountain system of Ireland.

First Year.—Say what you can of the vegetable productions of India.

Second Year.—Describe a coasting voyage round Australia.

4. *Arithmetic.—Candidates.*—In a mile race, A gives B 100 yards start, and beats him by 20 yards. If B can run the mile in 5 min. 8 secs., how long did A take?

Ans. 4 min. 47 secs.

First Year.—A man has £25, 17s. 6d., consisting of sovereigns, half-crowns, and shillings in the proportion of 1, 3, and 7. How many has he of each? Ans. 15, 45, 105.

Second Year.—A rectangular field contains 6 acres 132 poles; its length is to its width as 21 to 13: how many rods of fencing are required for it? Ans. 136.

5. *Music.—Candidates.*—What are "mental effects"? How are they modified?
What is the standard scale of pitch?

First Year.—Rewrite the following without change of key:—

m d s ˈd m l r t, s m ˈl t dˈ

Second Year.—Give and explain the three forms of the minor scale, ascending and descending, and explain *calando*, *legato*, *sforzando*.

AUTUMN EXAMINATION, 1900.

Fifth Month—February.

WORK TO BE PREPARED.

1. READING AND REPETITION.

Continual oral practice, with due attention to emphasis, modulation, clear enunciation and articulation.

2. ENGLISH.

Candidates.—Marmion, Canto vi., lines 444 to 568.
First Year.—The Traveller, lines 190 to 238, with twenty roots and meanings per week, and the derivation of all important words in the part of the poem set for preparation.
Second Year.—Julius Cæsar, Act iii., Scene 1.
All notes, meanings of allusions, derivations, etc., must also be prepared. For *notes*, see September number of THE PRACTICAL TEACHER.

3. ESSAYS.

Write one or two essays each week, selecting from the following:—The Telescope, Fruit Trees, Habits of Domestic Animals, The Force of Example, Your Favourite Book, The Changes of Fortune.

4. HISTORY.

Candidates.—Henry IV. to Richard III., 1485 A.D.
First Year.—Edward III. and Richard II.
Second Year.—James II.
} Notes below.

5. GEOGRAPHY.

Candidates.—The remaining counties of England.
First Year.—Finish Europe:—Holland, Belgium, Switzerland, and the countries of the Balkan Peninsula.
Second Year.—Physical features, climate, and productions of North America.

6. ARITHMETIC.

Candidates.—Addition, subtraction, multiplication, and division of decimals; their conversion to vulgar fractions, and *vice versâ*.
First Year.—Simple interest.
Second Year.—Stocks and shares.

7. EUCLID.

First Year.—Props. 13–16, and four deductions each week.
Second Year.—Props. 43–48, and four deductions each week.

8. ALGEBRA.

First Year.—Elementary factors, and their use.
Second Year.—Fractions generally.

9. MUSIC.

Candidates.—General exercises on the syllabus set.
First Year.—Practice in transitions, perfect to imperfect method, and *vice versâ*.
Second Year.—One-half of the musical terms in common use.

10. TEACHING.

Correction of dictation exercises.

Notes on the Month's Work.

1. ESSAYS.

Careful and systematic practice must be taken in composition. The subject of every essay that is to be written must be *studied*. It should be read up from every available source, the ideas selected, arranged for paragraphs, and then the essay written neatly and carefully. An essay should be sent in occasionally for criticism and advice.

2. HISTORY.

Candidates.—The following points in connection with this month's work must be clearly understood:—

Henry the Fourth was not the nearest heir to the throne; but he was not a usurper, as he was formally accepted by Parliament. The law of direct descent did not come into operation till 1701.

As Henry owed his position to the support of (*a*) the church, (*b*) the Parliament, and (*c*) the nobles, this led to (*a*) his supporting the church against the Lollards, (*b*) his surrendering to Parliament many of the privileges enjoyed by former kings (and hence the constitution advanced), and (*c*) quarrels with the nobles. There were four plots and risings to be suppressed.

Henry the Fifth diverted the Barons' attention from their own quarrels by directing them against a common enemy—France. His campaign in France, and the glorious victory of Agincourt, were the chief events of the reign. *Henry the Sixth* is an illustration of what is frequently met with in history—a weak-minded man following a very energetic and able father, or *vice versâ*. The long minority, the quarrels of the leaders, the loss of the French possessions, all prejudiced the people against him. When it became evident that Henry was deficient in ability and was childless, two claimants appeared who asserted their rights to be considered heir-apparent—the Duke of York, descended from the third and fifth sons of Edward the Third; and the Somerset family, descended from the fourth son.

A genealogical table must be learned showing their exact relations. The course of the Wars of the Roses; the character of Margaret of Anjou; Warwick the King-maker; Edward the Fourth, the brilliant and energetic soldier, but indolent and vicious king; the ability of Richard the Third, and his final overthrow, are likely topics for questions.

First Year.—Chief points in these reigns were given under "Candidates" in last month's course. The causes leading to the Peasants' Revolt are asked for more frequently than anything else in this reign. The following should be remembered:—

General causes of long standing—(1) The villenage, or state of serfdom to which nearly all the agricultural labourers were reduced by the Norman Conquest; (2) the payment of rent by means of labour; (3) the heavy market tolls demanded; (4) the Black Death and Statutes of Labourers. *The more recent causes were*—(1) Wycliffe's teaching, especially as given by the socialist "poor preachers;" (2) the discontent at the bad government and the loss of the French provinces; (3) the heavy and unjust taxation. It was a mere trifle that connected Tyler's name with the rising. The peasants demanded—(1) abolition of villenage; (2) general pardon; (3) liberty to buy and sell untolled in all fairs and markets; (4) rent of land to be fixed at fourpence per acre.

Second Year.—Chief points:—

(1.) Rebellions (*a*) of Argyll and (*b*) the Duke of Monmouth—the latter followed by the Bloody Assize in Dorset and Somerset.
(2.) Attempts of the king to rule by means of unjust judges and a standing army.
(3.) Declaration of Indulgence, 1687; renewed, 1688.
(4.) Subsequent arrest, trial, and acquittal of the bishops.
(5.) Invitation to William of Orange; landing of William; flight of James.
(6.) The Convention Parliament, 1689, and the Declaration of Right, settling the points at which king and people had been at variance since 1603—afterwards passed as the *Bill* of Rights.

3. GEOGRAPHY.

Care must be taken to prepare this subject thoroughly. The great mass of facts can never be remembered unless they are connected by means of plans, tables, maps, etc. The geography of a country is not known till a map of it can be drawn from memory.

4. ARITHMETIC.

The theory of decimals must be clearly understood, and the fact recognised that they are only a special class of vulgar fractions with denominators of 10 or some power of 10 unexpressed. Hence only those vulgar fractions can be expressed as

decimals whose denominators can be made into 10 or some power of 10 by multiplication by a whole number. In other words, when the denominator of a fraction, in its lowest terms, contains no other factor but 2 or 5, that fraction can be expressed as a finite decimal, and not otherwise.

When a recurring decimal is produced by dividing the numerator by the denominator, there is a *limit* to the number of recurring figures. Thus, if the denominator is 17, the decimal must recur in 16 places; for there are only 16 possible remainders, and the seventeenth must be one of those previously obtained.

This must be fully understood.

Simple Interest.—Exercises on this rule should be worked by method of unity, and *not* by formula. Special attention should be given to the rules for finding (*a*) time, (*b*) rate, (*c*) principal, etc., when the other terms are given.

Stocks and Shares.—The only difficulty likely to arise is from the confusion of the *face* value and the *real* value of scrip. A £100 share may be worth anything—or nothing.

5. Euclid.

All pupil teachers should use Egan's Exercises in Euclid. Try to solve the deduction without reference to the solution given, and refer to that only when difficulty is experienced.

6. Algebra.

The factors which occur most frequently are—

$(a + b)(a - b) = a^2 - b^2.$
$(a + b)^2 = a^2 + 2ab + b^2.$
$(a - b)^2 = a^2 - 2ab + b^2.$
$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3.$
$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3.$
$(a + b)(a^2 - ab + b^2) = a^3 + b^3.$
$(a - b)(a^2 + ab + b^2) = a^3 - b^3.$

These and their application should be thoroughly known.

Test Questions.

1. *Penmanship.*
Large Hand:—*The Philippine Islands.*
Small Hand:—*Genius is the capacity for taking infinite pains.*

2. *Candidates.*—Analyse lines 374–379.
Parse *must, no longer, yonder, foul fall him, first.*
First Year.—Paraphrase lines 175–185. Analyse the same passage.
Parse *still, even, though, rear, deal, each wish contracting.*
Second Year.—Paraphrase and analyse—

"Cowards die.....will come."

Parse *many times, but once, it seems, strange, seeing that, end.*

3. *Candidates.*
(*a*) Give some account of the later years of Edward the Third.
(*b*) Give the causes and results of the Peasants' Revolt.
First Year.
(*a*) Say what you can of the conquest of Wales.
(*b*) Mention the chief legal measures passed in the reign of Edward the First.
Second Year.
(*a*) What was the Clarendon Code?
(*b*) What do you know of the Test Act and the Habeas Corpus Act?

4. *Candidates.*
(*a*) Say what you can of Norfolk.
(*b*) Describe a coasting voyage from Sunderland to London.
First Year.
(*a*) Enumerate the chief ports on the Baltic, and say something of the trade of each. What has been done to render the entrance to the Baltic more easy?
(*b*) What do you know of the Black Lands, Steppes, Tundras, Crimea?
Second Year.
(*a*) Explain the causes which have given rise to the present crisis in the Transvaal.
(*b*) Mention the six chief ports of Africa, saying what is exported from each.

SCHOLARSHIP EXAMINATION, 1900.

Second Month—February.

Work to be Prepared.

1. *Reading, Repetition, and Penmanship.*—A few minutes' daily practice.

2. *Theory of Teaching.*—Chaps. ii. and iii., *Scholarship School Management.*

3. *Geography.*—(1) Revise Russia, Austria, and Switzerland; (2) India.

4. *History.*—Henry II. to Henry III.

5. *Composition.*—One or two essays each week on such subjects as—Athletics, Arbitration, Choice of a Profession, Civilisation, Discipline, Electricity, Habit, Influence of Mountains on Commerce.

6. *English.*
(1.) The grammar of the adjective.
(2.) Twenty-five roots and meanings each week.
(3.) The history of the language up to 1400.
(4.) *Julius Cæsar*, Act i., Scene 2, line 182, to the end of Act i.

7. *Arithmetic.*—Vulgar fractions.

8. *Algebra.*—Addition, subtraction, multiplication, and division of fractions.

9. *Euclid.*—Book I., Props. 11–20, and six deductions per week.

10. *Elementary Science.—The Mechanical Powers:* Principles of the lever, the pulley, the inclined plane, and the screw. *Energy:* Heat, radiation, electricity, and chemical actions as forms of energy; mechanical work. *Heat and Temperature:* Effects of heat; measurement of temperature by thermometers; change of state caused by heat, as in ice, water, steam.

11. *Languages.*
Latin, *Pliny's Letters*, No. 3. } Translation and retranslation.
French, *Le Trésor*, three pages. } Exercises in grammar.

12. *Drawing.*—A freehand copy each week. Geometry: construction of regular polygons.

13. *Music.*—Chap. ii., *School Music Teacher.*

14. *Domestic Economy.*—Chemical classification of foods, meats, vegetable and bread stuffs. Butter, cheese, milk, fish, game, etc., as articles of food. Relative digestibility and cost.

Notes on the Work for the Month.

1. *Reading, Repetition, and Penmanship.*—The warning given last month as to the danger of neglecting these apparently unimportant subjects must be borne in mind throughout the year. "Excellence" must be aimed at, and this can only be attained by persistent effort.

2. *Geography.*—In the revision of European countries, notebooks compiled while studying Europe for the Pupil Teachers' Examinations should be most useful.

India will require much careful preparation. Its history may be left till it runs contemporaneously with English history. The physical features and general outlines have been taken before.

The government of India is controlled from England by the "Secretary of State for India in Council." The Council consists of men who have spent many years in India. The present Secretary of State for India is Lord George Hamilton. In India, the Viceroy (Lord Curzon), the Commander-in-Chief in India (Sir William Lockhart), and five ordinary members form the Supreme Government. To this Council may be added the Governors of the other presidencies when the Council meets in their territory, and fifteen extraordinary members for making laws and regulations. The country is divided into eight principal provinces—namely, Madras, Bombay, Bengal, North-West Provinces and Oude, Punjab, Burma, Central Provinces, and Assam; and five smaller provinces—Berar, Ajmere Merwara, Coorg, British Baluchistan, The Andamans—under Governors, Lieutenant-Governors, or Chief Commissioners. The provinces are again subdivided into 250 districts, each under a Collector-Magistrate or Deputy Commissioner.

Area, 1,700,000 square miles, of which 750,000 square miles are under native rule. The population may be taken at 312,000,000, of whom 73,000,000 live in the native states.

The revenue for 1897–98 was.....Rx. 96,442,004. } Rx. = 10 rupees. A
The expenditure for 1897–98 was....Rx. 101,801,215. } rupee is worth 1s. 4d.

It may be seen from these figures that India is a *poor* country. The principal heads of revenue are land tax, opium tax, salt tax, stamps and excise, provincial rates, customs, forests, and tributes from the native states and railways.

The army consists of 73,000 British and 145,000 native troops.

The chief *imports*, in order of value, are—cotton goods and yarns, metals (excluding hardware and cutlery), sugar, oils, machinery, railway plant, liquors, provisions, woollen goods, hardware and cutlery, apparel, etc.

The chief *exports*, in order of value, are—rice, seeds, cotton, wheat, tea, cotton yarns and cloth, hides and skins, opium, jute, indigo, coffee, wool, pulse, teak, lace, oils and spices.

The largest towns (population over 150,000) are Calcutta, Bombay, Madras, Hyderabad, Lucknow, Benares, Delhi, Mandalay, Cawnpore, Bangalore, Rangoon, Lahore, Allahabad, Agra, Patna, Poona, Jeypore.

3. *History.—Chief Points:—*
Henry II.
(*a*) Restitution of order. Demolition of adulterine castles.
(*b*) Foreign possessions, and how obtained. (Prepare a map to illustrate.)
(*c*) Quarrel with Becket. Constitutions of Clarendon.
(*d*) Conquest of Ireland.
(*e*) Revolt of sons.
(*f*) Legal reforms—1159, Scutage; 1170, Inquest of Sheriffs; 1181, Assize of Arms; 1176, Assize of Northampton; institution of Justices in Eyre.

Richard I.
(*a*) Crusades.
(*b*) England in Richard's absence.

John.
(*a*) Loss of Normandy.
(*b*) Quarrel with the Pope, arising out of the appointment of an archbishop. Interdict. Excommunication. Abject submission.
(*c*) Quarrel with the Barons.
(*d*) The Magna Charta.
(*e*) John's attempts to evade the Charter. Civil war.

Henry III.
The king's minority. Hubert de Burgh and Peter des Roches. The king's personal rule. The Mad Parliament and the Provisions of Oxford. The Mise of Amiens. The Barons' War. The first representative Parliament. The dictum of Kenilworth.

De Montfort's Parliament is very important, since it first included direct representatives of the Commons. The Knights of the Shire, in attending, were only resuming the right they had allowed to lapse of attending the Magnum Concilium—the meeting of all the king's vassals.

4. *Composition.*—Take great care with the *construction* of the essays as well as the language. A clear analysis should always be prepared before commencing to write the essay.

5. *English.*—The syntax of the adjective must not be overlooked. Tabulate and commit to memory (*a*) adjectives that do not admit of comparison; (*b*) adjectives that are compared irregularly; (*c*) a clear classification of adjectives. The period set in the history of the language is very important. The Norman Conquest caused the introduction of many new words, derived mainly from the Latin (Latin of the third period). Norman French was the language spoken at court, by the nobility and their retainers, in the church and law courts. Anglo-Saxon still retained its place as the language of the *people*. The strife of tongues, which lasted some two hundred and fifty years, produced many alterations in both speeches. The Anglo-Saxon lost many of its inflections, the newcomers not endeavouring, or perhaps not caring, to understand them. The power of compounding words to express new ideas was also lost, and the differences between the three dialects were to some extent obliterated. The Normans introduced new ideas and new words, and thus the language was strengthened. The attempts of the Normans to spell the Anglo-Saxon words caused also much confusion in the spelling. The loss of the French possessions, and the necessity which the barons felt of considering England as their home, led to a fusion of the languages, the basis being Anglo-Saxon.

Chaucer was the first great writer to use this compound speech—English—as a medium for expression, hence his influence over succeeding writers.

The general rules by which Teutonic words may be distinguished from those of foreign origin must be learned.

(Each student should use *The Pupil Teachers' English Notebook* for this branch of the work.)

In studying *Julius Cæsar*, help may be derived from the notes given in back numbers of this paper. Difficulties in analysis and parsing will be answered in the course as desired by correspondents.

6. *Arithmetic.*—The theory of fractions must be thoroughly prepared. The rule of signs in complex and compound fractions must be carefully noted. Continued fractions of the form

$$\cfrac{1}{1+\cfrac{1}{1}+\cfrac{1}{1+\cfrac{1}{7}}}$$

will also require some attention.

Fractions may be compared in value either by reducing to a common denominator or to a common numerator. For example: Compare $\frac{3}{173}, \frac{4}{297}, \frac{6}{307}$. Reduce to a common numerator, 12. Then the fractions are $\frac{12}{692}, \frac{12}{891}, \frac{12}{614}$, and therefore come in the order $\frac{6}{307}, \frac{3}{173}, \frac{4}{297}$.

This is much shorter than reducing to a common denominator. The theory given in Christian and Collar *must be studied*. There is practically nothing to add to it. Work as many of the examples as possible, especially the miscellaneous examples. Send up for solution problems which present any difficulty.

7. *Algebra.*—Factors must be used in operations with fractions wherever necessary. Note the advantage of sometimes altering signs in fractions, and rules for so doing. (1) All the signs in numerator and denominator may be altered without affecting the value of the fraction; or (2) the sign in front of the fraction, and *either* all the signs in the numerator *or* all the signs in the denominator. Thus—

$$\frac{a-x}{b-y}=\frac{x-a}{y-b}, \text{ or } -\frac{x-a}{b-y}, \text{ or } -\frac{a-x}{y-b}.$$

8. *Euclid.*—Deductions must be regularly worked. The time allowed at the examination does not permit of much delay in solving them; hence the necessity for the speed which comes from practice.

9. *Drawing.*—Copies should be sent in occasionally for criticism.

10. *Domestic Economy.*—In dealing with the various articles of food, it is advisable to tabulate, showing what class of compounds they contain—nitrogenous, carbonaceous, mineral. Thus—

	Nitrogenous.	*Carbonaceous.*	*Mineral.*
White fish contains	Albumen and gelatin.	Very little.	Phosphates.

The absence of either class in a food is usually rectified by habitually eating with it some which supplies the missing constituent. For example, turkey being deficient in fats, is served with ham or sausages; bread (mainly nitrogenous) with butter (mainly carbonaceous).

Test Questions.

1. *Penmanship.*
Large Hand:—*Pietermaritzburg.*
Small Hand:—*O mighty Cæsar! dost thou lie so low?*

2. How may the memory be developed in school? When is "learning by heart" advisable?

3. Describe a voyage from Southampton to Alexandria, calling at Gibraltar, Malta, and Cyprus; or from Calcutta to Japan, calling at British possessions. Draw a sketch-map to illustrate your answer.

4. Say what you can of the industries of France and Germany.

5. What additions were made to the vocabulary of the language previous to 1066?

6. Reproduce in your own words Cassius's arguments to induce Brutus to join the conspiracy against Cæsar. What did he mean by, "There was a Brutus once"?

7. Point out the advantages and disadvantages of the Feudal System.

8. What do you know of the Investiture dispute and its settlement?

9. Give the laws of motion, and explain why the earth moves round the sun. Under what condition would the earth move straight to the sun?

10. Explain the process of digestion.

CORRESPONDENCE: RULES.

To ensure an answer in the next issue, queries must be sent by the 15th of each month.

Name and address of sender, with coupon of current number of THE PRACTICAL TEACHER (and *nom de plume* if desired), must be enclosed.

As a rule, all replies will appear in the Correspondence Column; but any one desiring an immediate reply may obtain it by enclosing a stamped addressed envelope.

All communications and queries with regard to the PUPIL TEACHERS' AND SCHOLARSHIP COURSE should be addressed to "Mr. A. T. FLUX, The Bays, Belvedere, Kent."

ANSWERS TO CORRESPONDENTS.

A. M. F.—See last month's paper.

Puzzled.—The two numbers are $7+3+5+3+2+2$, and $7+3+5+5+7+11$. Hence the L.C.M. must be $7+3+5+3+2+2+5+7+11$.

P. H.—There is no difficulty. The remainders equal 7 units and 6 8's = 55. If you divide by 9 first, the second remainder will be as many 9's as there are in 55 = 6, and the remainder from the first line 1.

H. J. M.—For recent information you should get "Whitaker," 2s. 6d. edition.

Inquirer.—No.

Other Correspondents answered by post.

OUR CERTIFICATE COURSE FOR 1900.

BY GEORGE COLLAR, B.A., B.SC.,
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TEST QUESTIONS ON THE JANUARY WORK.

THEORY OF TEACHING.

FIRST YEAR.—How would you apply the principle of proceeding "from the known to the unknown" to the teaching of geography?

SECOND YEAR.—1. What is a "concept"? To what extent is it true to say that education consists in the enlargement of the content of concepts?

2. How does Plato work out the parallel between individual and public virtue?

ENGLISH.

FIRST YEAR.—1. Why is the third person singular of *must* and *ought* written without an *s* (that is, *he must*, not *he musts*)?

2. What light does the conjugation of verbs throw on their origin?

3. Give the substance of Macaulay's parallel between Milton and Dante.

SECOND YEAR.—What are the characteristics of epic poetry? Name the great epics in the world's literature, and compare one of them, if you can, with *Paradise Lost*.

GEOGRAPHY.

BOTH YEARS.—1. Describe the physical features of the German Empire.

2. Give an account of the industries of Holland and Belgium.

HISTORY.

BOTH YEARS.—Describe the Anglo-French conflict for supremacy in India.

ALGEBRA.

WOMEN—BOTH YEARS.—1. Find the L.C.M. of $x^2 - 3x + 2$, $x^2 - 5x + 6$, and $x^2 - 7x + 12$.

2. Find the G.C.M. and L.C.M. of $6a^4 + 5a^3b - 10a^2b^2 + 7ab^3 - 2b^4$, and $12a^5 + 7a^4b + 3a^3b^2 - 4a^2b^3 + 5ab^4 - b^5$.

MEN—FIRST YEAR.—A shopkeeper buys £40 worth of calico from a manufacturer, and retails it at a profit of £12. He again buys £40 worth, but getting 160 yards more for his money, retails it at ½d. per yard less than before, and yet makes the same profit. What price per yard did he charge?

MEN—SECOND YEAR.—Define the terms "logarithm," "characteristic," and "mantissa." Why is the characteristic omitted in tables calculated to the base 10?

Having given that $\log_{10}2 = \cdot30103$, and $\log_{10}3 = \cdot47712$, find $\log_{10}4050$ and $\log_{10}\cdot00405$.

GEOMETRY.

MEN—FIRST YEAR.—PQRS is a semicircle, of which PS is the diameter, PR is produced to V, and QR is joined. Show that the angle QRV is obtuse.

MEN—SECOND YEAR.—Describe a regular pentagon about a given circle.

What addition must be made to the construction if a side of the pentagon required is to pass through a given point? How must the position of the point be limited in order that the proposition may be possible?

FRENCH.

FIRST YEAR.—1. What is the difference between *devant*, *avant*, *avant que*, and *auparavant*?

2. Which of the prepositions must be repeated before every noun they govern? Which is the only preposition that can govern the present participle?

SECOND YEAR.—Give a summary of the chief rules for the agreement of the past participle, with examples.

SYLLABUS AND HINTS FOR FEBRUARY.

ENGLISH COMPOSITION.

Write essays on the following subjects:—

[*N.B.*—Draw up an abstract of each first.]

1. International arbitration.
2. Courage.
3. Improvement in the social conditions in England during the present century.

THEORY OF TEACHING.

FIRST YEAR.—*Object lessons and elementary science lessons.* The student should read carefully Circular 369, issued June 25, 1895, by the Education Department. This circular forms the introductory chapter in Dexter and Garlick's *Object Lessons*, a book which will not only assist the teacher in collecting his materials, but afford valuable help in the best methods of giving object lessons.

The circular raises one question which is very difficult to answer—namely, Where are we to draw the line between "Object Lessons" and "General Information Lessons," and between "Object Lessons" and "Elementary Science Lessons"? The suggestion is that the term "Object Lesson" should be confined to lessons given on things which the children can observe for themselves. But this would include the whole of botany and zoology, and, indeed, spectroscopic observations on the stars would come under the head of "Object Lessons," while "Dangers from fire, and how they may be avoided," "The West Riding of Yorkshire: factories, etc.," and other things mentioned in the list appended to the circular, pertain rather to the "General Information" class. Perhaps the best way to classify these lessons is to call those which have for their principal object the training of the observation "Object Lessons," while those in which greater prominence is given to the knowledge to be imparted should be called "Information Lessons" or "Elementary Science Lessons," the latter being more systematic than the former. But it is impossible to draw a rigid line. The most common fault in object lessons is the excess of work done by the teacher. In the object lesson, children should be taught how to study an object for themselves. The effectiveness of object teaching is often marred by want of sequence in the course of lessons.

Logic.—Study carefully Jevons, Lessons xvi. and xvii. This forms perhaps the most difficult part of the subject. At first the symbols A, E, I, and O, representing the kinds of propositions, and their combinations A, E, A, etc., representing the moods of the syllogisms, may appear uninteresting. If so, the student should revise Lesson viii.; for the symbols can be of interest only when the mind easily recalls that of which they are the symbols. The eight rules which enable us to decide whether a given syllogism is valid or not were studied last month, and the student should go through all sixty-four possible moods one by one, and by applying these canons determine for himself whether each one is valid or not. This will not only serve to fix the subject in the student's mind, but will be a valuable preparation for any examination, since questions on this part of the subject generally take the form of an interrogation whether a given form is a valid syllogism or not, when, if it is not valid, the student must give his reasons for rejecting it. The mnemonic lines given on page 145 should not be committed to memory until their full signification has been mastered; they will then be easily remembered, and will prove a great help to the student in reducing his figures. We must, however, press upon our readers the absurdity of trying to work out logic mechanically. Each reduction requires careful thought.

SECOND YEAR.—*Judgment and Reasoning.* A judgment is the recognition of a relation between two things. The student will remember that the *statement* of such a relation is called a proposition. If we perceive a thing or recall it, we may relate it—(*a*) with a single individual perceived or recalled to mind; (*b*) with a number of similar things, or with our concept based on the similarity of a group of things. Thus—

(*a*) *John* is *my brother.*

(*b*) *The cat* is a *quadruped.*

It is usual to classify judgments as (*a*) "intuitive," and (*b*) "deliberative," according as they are formed with or without effort. It is doubtful, however, whether any judgments are arrived at absolutely without effort. Even if a person looks at a piece of cloth and says, "This cloth is black," there must be a certain short period of indecision preceding the judgment; for another person might say it was a very dark blue, and another that it was a very dark brown, and we must therefore conclude that it was possible for the first person to decide in the same way as either the second or third. The amount of deliberation, however, is extremely small, and the person seems to arrive at his judgment simply by "looking on" the cloth, hence the term "intuitive judgments" (from Lat. *intueor*, I look on). Many of our æsthetic and moral judgments are regarded as intuitive, simply because it is difficult to say why the ultimate choice was made in the direction it actually took. Thus we decide that a certain mountain is grand, a rainbow is beautiful, a certain course of conduct good, without apparently stopping to think wherein the grandeur, the beauty, or the goodness consists.

The mistakes most commonly made by teachers in the matter of judgment are:—

(*a*) Not allowing the percepts to be sufficiently clear before calling for a judgment.

(*b*) Supplying judgments second-hand.

(*c*) Neglecting to exercise the pupil's judgment altogether.

The second of these faults is not confined to the schoolroom, but pervades all classes of society, and leads to the readiness with which statements are accepted and repeated simply because some one has made them before, or because they have appeared "in print."

If the student has thoroughly mastered the section on "Judging," he will have no difficulty in mastering that on "Reasoning," particularly if he recalls his course on Logic.

Arithmetic.

Profit and Loss.—This rule will present very little difficulty to those who remember that a percentage is a fraction, and that in order to give it a concrete meaning we must speak of a "percentage of" something. Thus the expression, £5 = 10 per cent., is meaningless; so also such a statement as, "A man sold a table for £3, 15s., making a profit of 25 per cent.," would be absurd unless there was a concrete meaning implied in the phrase "a profit of 25 per cent." It is permissible to speak of a profit or loss of 25 per cent., because it is always understood (unless the contrary is stated) that a gain or loss is estimated as a *percentage of the cost price*. The great thing, therefore, in this rule is to acquire a facility in regarding all quantities mentioned as percentages of the cost price. If goods are sold at a "profit of 20 per cent.," the selling price will be 120 per cent. of the cost price. It is advisable to work examples at first in which a selling price, or profit, or loss has to be found from a given cost price; or *vice versâ*, in which a selling price, or profit, or loss under certain conditions is given, and the cost price has to be determined; or selling price and profit may be given and the conditions—that is, rate of profit—determined. These exercises may be regarded as applications of the principles we explained last month. The class of question in which the selling price at one percentage is given, and the selling price at another has to be found, is a frequent source of trouble, and many who get the right answer lose marks for adopting an unnecessarily long method.

Example.—By selling 8 tons of tea at 1s. 6½d. per lb., a merchant loses 7½ per cent. At what price should he sell it in order to gain 10 per cent.? (First Year Certif., 1889.)

In the first place, note that the 8 tons does not affect the question; next, that the two prices are not proportional to 7½ and 10—in fact, the 7½ per cent. is a *loss*, and the 10 per cent. is to be a *gain*. Considering both quantities as percentages of the cost price, we see that 1s. 6½d. is 92½ per cent. of the cost price, and we have to find 110 per cent. of the cost price. Now, since these are *percentages of the same quantity*, we see that the second is $\frac{110}{92\frac{1}{2}}$ of the former. Hence the answer required is—

$$= \frac{110}{92\frac{1}{2}} \text{ of 1s. } 6\tfrac{1}{2}\text{d.}$$

$$= \frac{220}{185} \text{ of 1s. } 6\tfrac{1}{2}\text{d.}$$

$$= \frac{44}{37} \text{ of } \frac{37}{24}\text{s.} = \frac{11}{6}\text{s.} = \text{1s. 10d.}$$

This simplification is the only working required. It should be noticed that the solution is effected in *one* step. It is sheer waste of time to find first the cost price, and thence find the second selling price.

Questions are sometimes set in which the gain is at a different rate on different fractions of the quantity of goods sold. In such cases it is better to substitute that percentage of the whole quantity which is the equivalent, and then add or subtract.

Example.—A person sold half his goods at a profit of 20 per cent., a third at a profit of 12 per cent., and the rest at a loss of 60 per cent. Find his gain or loss per cent. on the whole.

20 per cent. on a half = 10 per cent. on the whole,
12 ,, ,, third = 4 ,, ,, ,,
60 ,, ,, sixth = 10 ,, ,, ,,
Hence total profit = (10 + 4 − 10) per cent. on the whole
= 4 per cent. on the whole.

Note that we subtract the losses; and had the total losses been greater than the total gains, the final result would represent a loss.

Work a wide variety of examples, and send up difficulties.

English.

First Year.—Historical grammar of the pronouns. Remember that in Anglo-Saxon there were four cases. Taking the first person singular, we have nom. *Ic* (= I); acc. *mec* or *mé* (= me); gen. *mín* (= my or mine); dat. *mé* (= to me). In the south *Ic* became *Ich*; and we find in *King Lear* that Edgar, personating a Somersetshire peasant, says, "*Ch'ill pick your teeth*," where Ch'ill = Ich will. The *c* in acc. *mec* was dropped, so that the accusative resembled the dative, which was forced to adopt the preposition "to" as its distinguishing mark. The genitive form "mine" is seldom used now before a noun, but has supplied the form of the possessive pronoun. The vulgar forms *hisn*, *yourn* show the force of the genitive inflection *n*. Notice also the forms of the second and third persons, and observe that the form "its" is quite modern; the original form was "his" for the neuter. (See Gen. i. 11: "The fruit tree yielding fruit after *his* kind.") The form "it" was sometimes used as possessive,—

> "The hedge-sparrow fed the cuckoo so long
> That it had *it* head bit off by *it* young."
> *King Lear*, i. 4.

The relative and interrogative forms require attention. Note the transposition of the *h* and *w*—*hwá* has become *who*—and observe that the objective *whom* is from the dative *hwam*. The form *which* used to apply to persons (see Lord's Prayer), and the form *whose* was not limited to persons (see Gen. i. 11, quoted above).

Read carefully through Johnson's *Life of Milton*, observing the general relations of the parts of the composition, and remembering the matters which are personal to Milton. We will take up the literary criticisms next month.

Second Year.—Read the next eight Essays of Leigh Hunt—"Thieves, Ancient and Modern" to "On Dreams."

Study carefully *Paradise Lost*, I., lines 156–521.

176. *His.* See first year work above.

178–179. That is, whether our foe yield it to us through scorn, or because his fury has satisfied itself.

191. *If not.* The two lines should evidently be inverted. The meaning is not that they should seek reinforcement from hope should they fail to get resolution from despair. "If not" = "if we can gain none, then let us see" [what resolution we can gain from despair].

197. *As whom* = as those whom. Note the omission of the relative, a frequent construction with Milton.

206. *Scaly rind.* Milton's leviathan could not be the whale, as the whale is not covered with scales. It was no doubt a purely imaginary monster.

207. *Under the lee* = on the side offering protection from the wind.

211–220. Notice the strength and beauty of these lines.

226. *Incumbent* = lying upon; supported by.

257. *All but less.* The context shows the meaning to be "only a little less," but the phrase itself is peculiar.

289. *Optic glass.* The telescope, first used by Galileo the astronomer. Milton visited Galileo in his visit to Italy. He is called an "artist," but the fact is that a close distinction was not formerly made between arts and sciences.

294. *Ammiral* = flagship; from the Arabic *amir* or *emir*, a leader.

351. *A multitude.* The simile is drawn from the invasions of the Goths, Teutons, Vandals, and Huns from the north of Europe from the second to the fifth century A.D. The Vandals actually got as far south as Africa (= Lybian sands).

376–521. Here we have a pause in the course of the narrative, to allow the heavenly Muse, in response to the poet's invocation, to describe the chief supporters of Satan.

412. *Peor*—that is, Baal-peor. (See Num. xxxi.)

418. *Josiah.* See 2 Kings xxiii. In ver. 4 we read that he burned the idolatrous material in the fields of Kidron—that is, in the valley of Gehenna, "the type of hell," line 405, *ante*.

423. *Feminine.* It should be "female." It is incorrect to apply feminine to *sex*; it refers to *gender*.

437. *Despicable.* Note the accent.

444. *Uxorious king*—that is, Solomon. The epithet is explained in 1 Kings xi. 3. In ver. 5 of the same chapter we read that he "went after Ashtoreth, the goddess of the Zidonians."

455. *Ezekiel saw.* See Ezek. viii. 14.

460. *Grunsel.* Threshold. Another form is "groundsill."

506. *The prime.* The chief. It will be noticed that Milton gives higher rank among the enemies of God to the Old Testament idols than to the gods of the Greeks and Romans. Notice the genealogy of the latter.

Geography (Both Years).

The commerce of Germany. Germany ranks as the second commercial country of the world, the overland trade and the maritime both being very extensive. All the trade is regulated by the Zollverein—Hamburg and Bremen, formerly "free ports," having joined the Union (1888).

The greatest trade is done with England, the countries lying on the German borders, and the United States of America.

Much of the trade is carried through Antwerp by rail, through Rotterdam by river, and through the St. Gothard Tunnel to Genoa and Trieste.

Study the chief exports and imports. Note especially the trade with Great Britain. Germany, at one time a customer for textile and other goods, now competes vigorously with England in textiles, machinery, and metal goods.

German trade has been increased (1) by colonial extension—Germany now struggling for commercial supremacy in the new markets opened up in Africa; (2) by the lines of Transatlantic steamers running from Hamburg and Bremerhaven—the majority of German emigrants no longer pass through Liverpool, while much less American produce than formerly is sought in England.

Study the great ports and the outports on Baltic and North Sea shores.

In studying the means of internal communication, note the great importance both of railways and canals, and their connections with those of France, Holland and Belgium, Austria-Hungary, Switzerland, and Italy. Mark in a map the position and direction of the most important railways and canals.

The political divisions of Germany should be studied from the map, as well as the most important towns in each.

When the division into kingdoms (4), grand duchies (6), duchies (5), principalities (7), free cities (3) is known, then the facts relating to each, learned in the general geography of the empire, should be gathered together, in order that the student may be able to describe any part of the country. Alsace-Lorraine, including Strasburg the capital, and Metz, a strongly-fortified town, now (since the Franco-German War of 1870–71) forms part of the German Empire.

Denmark. Denmark includes the low, flat peninsula of Jutland, and the islands of Zealand, Funen, Laaland, Falster, and Bornholm.

Study the exact position of each, drawing a sketch-map. The whole is about twice the size of Wales.

Note the extensive coast-line, which, together with the position of the country, is most favourable to maritime commerce; much of it, however, is very low, and is protected by dikes.

The country generally is low and flat, though parts of some islands have a varied surface. There are no large rivers or lakes, though small ones are very numerous. Both peninsula and islands contain well-wooded tracts.

Compare the climate with that of Great Britain: it is colder, latitude for latitude, as evidenced by the freezing of the Baltic; it is moister, the prevalent wind being, as with us, the south-west.

The pastures and fisheries are the great sources of wealth; consequently the people are engaged in—

1. Farming, chiefly in Jutland: sheep and cattle are reared, butter and cheese produced.

2. Fishing: most of the people on the sandy west coast are fishers—flounders, herrings, seals, and porpoises.

Other occupations which employ some of the people are—

Agriculture, grains being grown.

Mining in Bornholm, which produces some coal, building stone, marble, and porcelain clay.

Manufacture by hand of rough woollen cloth and wooden shoes.

Denmark is not a great trading country, though commerce, especially with Germany and Great Britain, thrives; and the Danes are good sailors. Scandinavia, Russia, and the Danish colonies also trade with Denmark.

The trade between the United Kingdom and Denmark consists in the export of farm produce from Denmark, and the import of coal and manufactured goods from England.

Study chief imports and exports of the country, and the six largest ports.

Internal communication is carried on by means of excellent roads, good railroads, and the Agger Canal, connecting the Kattegat with the North Sea, through Lym Fiord.

Mark on a map the chief railway routes:—(1) From Copenhagen to Korsör; (2) from Frederikshavn to Vamdrup; (3) from Copenhagen to Elsinore.

Note the connections by rail or steamer with—(1) Brussels, Paris, London; (2) Altona and Hamburg; (3) Helsingborg in Sweden.

The large ports are the chief towns. Note also, and mark in map, Odense, Svendborg (well known for its distilleries, as well as its shipbuilding), Skagen (most important fishing-station of Denmark, sending large quantities of soles, turbot, whiting, cod to Copenhagen), Ronne in Bornholm (noted for pottery and clocks).

Switzerland. Switzerland, the Helvetia of the Romans, a Federal Republic rather more than half the size of Scotland, has strong mountain frontiers, but no sea-coast.

Study carefully the position and the boundaries of the country, using a sketch-map in the ordinary way. When studying the surface of Switzerland, read a good general description of the Alpine system.

The country is the highest and most mountainous in Europe: the Alps occupy all the south and east of the country; the Juras lie along the west and north-west on the French borders; between these two systems is the Swiss plateau, extending from Lausanne north-east through Fribourg, Berne, Olten, etc.

The Alps in the south are divided by the Rhone Valley, to the north of which are the Bernese Alps (containing Jungfrau, Finsteraarhorn, Aletschhorn), and to the south the Alps of Valais, or Pennine Alps (with the crests of Matterhorn, Monte Rosa, etc.).

The Alps in the east are divided by a similar valley—that of the Rhine. North of the river are the confused masses of the Alps of Glarus; while to the south are the Rhætian Alps, beyond which lies the valley of the Engadine, with the river Inn flowing to the Danube.

In order to aid the study of the surface of Switzerland, use the best "physical" map that can be obtained, and trace out the valleys in which the rivers and lakes lie.

History.

Both Years.—From the accession of George the Third to July 1766.

Personal character of George the Third. See Thackeray's *Four Georges*, and compare George the Third with his two predecessors.

Disagreement with Pitt, who wished to declare war against Spain because its king, Charles the Third, had agreed to help France, which was on the point of coming to terms and closing the Seven Years' War. Pitt resigned, but events proved his policy to be the correct one. Spain, after certain preparations, declared war, but met with no success. Notice carefully the details of the treaty of Paris, 1763, which closed the Seven Years' War.

Premiership of Bute (Oct. 1761–April 1763). Bute owed his position to favouritism, and his ministry serves to illustrate the corrupt condition of parliamentary government at the time, nothing more.

Wilkes and *The North Briton*. Remember the ruling of Chief-Justice Pratt, that the privileges of a member of Parliament precluded his arrest except for treason, felony, or a breach of the peace; also that "general warrants" were illegal. The prosecution of Wilkes served to increase the unpopularity of the king and of Grenville, who had succeeded Bute as prime minister.

The American Stamp Act. Reasons for its imposition good, but it was unconstitutional to tax people who had no parliamentary representation. Formation of the Rockingham Ministry. Repeal of the Stamp Act. The Act was repealed, but the repeal contained a declaration of the right of the British Parliament to tax the colonies; and as it was the principle rather than the amount of the tax to which the colonists objected, the repeal did very little to heal the sore caused by the imposition of the tax.

Algebra.

Women—Both Years.—Simultaneous equations involving two unknown quantities. Notice that there must be as many independent equations as there are unknown quantities. Thus with two unknowns there must be two equations, and from these two we must first form one equation with one unknown. Notice the three methods by which the other may be eliminated. Work plenty of examples; take some and work them by all three methods.

Men—First Year.—Simultaneous equations involving quadratics. There are several special methods of solving these:—(*a*) When one of the equations is wholly of the first degree, it is best to find the value of one unknown in terms of the other, and substitute in the second equation. (*b*) When both are homogeneous and of the second degree, it is best to substitute $y = mx$, and by dividing one equation by the other eliminate x, and determine the value of m.

Men—Second Year.—Continue the theory of logarithms and its applications to finding products, powers, quotients, and roots. It is advisable to get a book of mathematical tables; Chambers's is about the best.

Latin.

See Practical Teacher Matriculation Course.

French.

First Year.—Adverbs and conjunctions; their relations to other parts of speech, and to the moods of the verbs. *Voyage au Centre de la Terre*, chaps. xlv.–li.

Second Year.—*Le Roi des Montagnes* (Practical Teacher Press Series) to end of chap. v. Exercises 14 and 15, paying attention to the rules for the subjunctive mood and the notes at the head of the exercises.

LONDON MATRICULATION.

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BY R. C. B. KERIN, B.A. (LOND.),

First in First Class Classical Honours at Final.

LATIN COURSE FOR FEBRUARY:

1. Cæsar, Book V. chaps. xv. to xxiii.
2. Grammar.—Prepositions and conjunctions; irregular verbs of the first and the second conjugation; the uses of the participles, supines, infinitives, and the subjunctive in principal sentences. Revise the declensions.
3. *Anglice Reddenda*, Nos. 50–60.
4. Sentences from Bradley's *Arnold* or Bayfield's or Allen's *Exercise Book*.

Notes on Grammar.

The supines are really the accusative and ablative respectively of a verbal noun. The supine in *um* is chiefly used to express purpose after a verb of motion, and is a relic of the old usage of the accusative without a preposition to express "motion to." The supine in *u* is used after certain adjectives.

A Latin verb does not possess as many participles as an English verb. For example, I have pointed out already in the notes that the perfect participle active is wanting except in deponent verbs, and I have mentioned the substitutes for it. Remember that often in English a present participle is equivalent to a perfect participle; and in turning sentences into Latin be careful not to use the present participle except when the time of the action denoted by the participle is the *same* as that of the verb to which it is attached. For example, "Seeing this, he went away," will not be translated by *hoc videns abivit*, but by *hoc viso abivit*, as the action denoted by "seeing" is antecedent to that denoted by the verb "go away." Note how a "when" clause is often neatly turned by a present participle in agreement with the direct or indirect object of a verb—for example, in a sentence given at matriculation, "He gave me money when I did not ask for it," *Mihi non roganti pecuniam dedit*, and "He praised Balbus when absent," *Balbum absentem laudavit*.

The uses of the gerund and gerundive are very important. In form the neuter of the gerundive is the same as the gerund. The gerund is, however, a verbal noun supplying the oblique cases of the infinitive, is active in meaning, and governs the same case as the verb from which it comes.

The genitive of the gerund is used after nouns and adjectives in answer to the question, "what kind of?"—for example, *ars scribendi*, "the art of writing"—and also after certain adjectives, as *cupidus*, etc. The dative of the gerund is used to denote work contemplated, generally in legal phrases. The accusative is used with the preposition *ad* to express a purpose. The ablative is used to denote the instrument or means. Sometimes it is used with the preposition "in."

Uses of the gerundive:—(*a*) It is used as a verbal adjective, is passive in meaning, and is almost equivalent to a future passive participle—for example, *liber emendus*, "a book to be bought" (that is, a "book worth buying"). (*b*) It is used as a finite verb with the parts of *sum* to denote necessity, agreeing with its subject. The agent is expressed by the dative. In English we prefer to use the active in translating. For example, *Hæc nobis laudanda sunt*, "We must praise these things" (literally, "these things are to be praised by us"). This is one of the ways of translating "must" into Latin. If the Latin equivalent for the English verb is intransitive—for example, "We must die"—the Latin will be *Nobis est moriendum*.

Grammarians hold different views on what *moriendum* is. Most hold now that it is the nominative of the gerund, and that the literal translation is, "There is a dying by us." Others hold that *moriendum* is the gerundive used impersonally (literally, "it must be died by us"). Again, in the sentence, "She who must be spared." Now, to translate this by *Ea quæ parcenda est* would be utterly wrong, because *parco* is an intransitive verb in Latin, as it governs the dative; hence we should say *Ea cui parcendum est*.

The gerundive is used for the gerund when the latter would naturally be used with an accusative case after it—for example, *spes bellum conficiendi* becomes *spes belli conficiendi* (the accusative goes into the case of the gerund, and the gerundive agrees with it). In the accusative and ablative this change must be always effected. This was the point in the question asked a few years ago, "Correct or justify *Ædes ad deos colendum struxit*, 'He built a temple to worship the gods.'" *Colendum* should have been *colendos*, to agree with *deos*. *Ædes*, too, ought to have been *ædem*, as *ædes* in the plural means "a house."

Neuter pronouns and adjectives are not attracted when, if attracted, they cannot be distinguished from the masculine—for example, *spes hoc faciendi*, "the hope of doing this." If *hoc* were attracted to *huius*, the latter would be confused with the masculine (= of this man).

The use of the tenses of the infinitive in Latin affords difficulty to a beginner. The present infinitive denotes the same time as that of the verb on which it depends. *Dixit puerum sapientem esse*, "He said the boy was wise" (at the time he was speaking). *Dixit puerum sapientem fuisse* would mean, "He said the boy was wise" (previously to the time of his remark).

The perfect infinitive is not to be used in Latin unless the action denoted by it is antecedent to that denoted by the verb on which it depends. Now, students should be very careful to avoid using the perfect infinitive after the verbs *debeo*, *possum*, etc., since the action denoted by the infinitive cannot possibly be antecedent to the duty, possibility, etc., expressed by these verbs. Hence we must say in Latin, *Hoc facere debui*, "He ought to have done this;" *Hoc facere potuit*, "He could have done this."

Note how the future infinitives, active and passive, are formed. The future infinitive active is formed by the future participle and *esse*, or by *fore ut* and the subjunctive when the supine of the verb is wanting. The future infinitive passive is formed by *iri* (the present infinitive passive of *eo*) and the supine in *um*. The future infinitive is used in Latin if the time of the action denoted by the infinitive is future to that denoted by the verb on which it depends. Take, for example, the sentence, "He said the kings would be killed." Here the action of "killing" is future to that of speaking, hence the future infinitive passive must be employed, and we write, *Dixit reges interfectum iri*, the literal translation of which is, "He said there was a going to kill the kings." Remember that *interfectum* is the supine, not the perfect passive participle, and is not, of course, affected by the number of *reges*, which is its object. Remember, too, the use of the future infinitive after *spero*, *minor*, *promitto*. You must avoid using the infinitive as subject, except when it is the subject of (1) an impersonal verb; (2) the verb *est* with predicate—for example, *dulce est pro patria mori; hoc facere me iuvat*.

In the sentences, we have given the rules for the use of the accusative and infinitive after verbs of *sentiendi* and *declarandi*.

The historical infinitive is an infinitive found in vivid narrative. This is the only occasion in Latin where the subject of the infinitive is in the nominative case. The historical infinitive is not confined to history; there are several instances of it in poetry.

The classes of verbs that take the infinitive as complement are important.

Adjectives in prose, except *paratus*, do not take the infinitive as complement. Avoid expressions like *dignus hoc facere*.

Note that the subject of an infinitive, except in the case mentioned above, is put in the accusative; but when indefinite it is generally omitted, and adjectives, etc., referring to it are put in the accusative singular—for example, *sapientem esse decet*, not *sapiens esse decet*.

The adjectival complement of the infinitive is, however, in the nominative when the subject of the infinitive is not indefinite, and is not expressed—as, *Vult esse bonus*, "He wishes to be good."

Remember that verbs of fearing are followed by the infinitive in Latin when followed by the infinitive in English—as, *Timet mori*, "He fears to die." The infinitive of exclamation is important—for example, *Eumne hoc fecisse!* "Fancy his having done this!"

The uses of the subjunctive in principal sentences come under four main heads: (1) Dubitative or Deliberative, (2) Potential, (3) Optative, (4) Prohibitive and Hortative.

Latin Sentences.

(Readers can have their solutions corrected by sending them to the Editor Matriculation Course *P. T.*, and enclosing seven stamps.)

1. It seems that all of us were too brave to run away from the city of Rome.
2. It is said that Balbus can prevent you from selling this book for 254 sesterces.
3. We ordered each of the soldiers to sell the citizens fifteen pecks of corn apiece at five sesterces per peck.
4. We cannot send him word at once to the effect that the citizens have repented (*pœnitet*) of their crimes.
5. He received a mortal (*mortifer*) wound while fighting with the enemy.
6. It is doubtful whether he will persuade your friend to do this or be himself persuaded to remain neutral (*neutri favere*).
7. At the age of sixty the illustrious Claudius died, and was buried in Naples, a city which was twenty miles distant (*absum*).

8. We might have killed such a coward (*ignavus*) as this man without being punished.

9. I know he would never have attacked the enemy without ascertaining (*cognosco*) how numerous they were.

10. You ought not to have made it your aim to (*id agere ut*) slay these men without asking me if it were wise to form this design (*consilium*).

Typical Sentences.

19. "The brave Balbus would have threatened to put to death all the most seditious citizens if you had informed him of the disaster at Athens."

Balbus vir fortis se civium seditiosissimum quemque interfecturum minatus esset si de clade Atheniensi eum certiorem fecisses.

Notes.—(*a*) "Would have," in a principal sentence, is rendered in Latin by the pluperfect subjunctive, if "would have" implies a condition that has not been carried out; and if the "if" sentence is expressed, the verb in that sentence will be either in the pluperfect or imperfect subjunctive. Hence here we have *fecisses*, and not *feceras*. (*b*) *Minor*, as explained before, is followed by the accusative and future infinitive. (*c*) Note the phrase for "to inform." The adjective *certior* agrees with the object of *fecisses;* as the object here is *eum*, *certiorem* is used. (*d*) "Of," depending on a verb where you could substitute "about," is generally expressed by *de*, and not by the genitive —for example, "I talk of this man," is *de hoc loquor*, not *huius loquor*. (*e*) Note *Balbus vir fortis*, not *fortis Balbus*. (*f*) "All the," followed by a superlative adjective, is expressed by a superlative adjective and *quisque*. *Quisque* follows the adjective.

20. "If each of us were to stop a week in Rome and ten days or more in Capua, you would not be satisfied."

Si nostrum quisque Romae septem dies et Capuae decem vel plures dies maneat, non sis contentus.

Notes.—(*a*) "Would," in a principal clause implying a condition, is expressed by (1) the present subjunctive, if the action refers to the future; (2) by the imperfect subjunctive, if the action refers to the present or to the past. Here the action refers to the future. Now in the "if" clause the subjunctive must be used if the verb in the principal clause is subjunctive, and the tense of the subjunctive will be the same as that in the principal clause. Hence in the sentence we write *sis*. (*b*) A week was a division not known to the Romans, therefore use *septem dies*. (*c*) "More" will have to be plural, agreeing with *dies*.

21. "We say that his father would not have injured such men as these if word had been brought to him to the effect that the town was taken."

Negamus patrem eius his talibus nociturum fuisse si ei oppidum captum esset nuntiatum.

Notes.—(*a*) Here "would have" occurs in a sentence which in Latin has to be expressed in the accusative and infinitive, as it depends on a verb of saying. Therefore the pluperfect subjunctive is not admissible, but the future participle with *fuisse* is used instead; hence *nociturum fuisse* is used above. (*b*) When in English we use a verb of saying, followed by a negative "that" clause, we must not express this in Latin by *dico* followed by a negative infinitive clause, but use *nego* and a positive infinitive clause. The literal translation of the sentence given above is, "We deny that his father would have injured." (*c*) The subjunctive *nuntiatum esset* is due to the rule given in sentence 19, as *nociturum fuisse* represents *nocuisset* in Oratio Recta. (*d*) *Captum*, the perfect infinitive, is used, as the action of *captum* is antecedent to that of *nuntiatum esset*. (*e*) "Such men as these" = "these such men." (*f*) *Noceo* governs the dative.

22. "I should like him to ask your brother what would have happened if the town had been burned by the king."

Velim tuum fratrem roget quid eventurum fuerit si oppidum a rege incensum esset.

Notes.—(*a*) "I should like," expressed by present subjunctive *velim*, is followed by the subjunctive without *ut* when the subject of the following verb is *not* the same, and by the infinitive when the subject of the following verb is the same. "Would have," in dependent, interrogative, and consecutive sentences (1) if the verb is active, is expressed by the periphrastic perfect subjunctive; (2) if the verb is passive, by the gerundive, with the perfect subjunctive of *sum*. Hence here we have *eventurum fuerit*. (*b*) *Incensum esset* is used according to the rule in sentence 19. The verb on which it depends would, if not dependent on *roget*, have been written *evenisset*. The change of *evenisset* to *eventurum fuerit*, necessitated by its dependence on *roget*, will not, of course, affect the mood and tense of *incensum esset*.

Sentences for Practice.

(Readers can have their exercises corrected by sending them to the Editor Matriculation Course *P. T.*, and enclosing seven stamps.)

Turn into Latin:—

1. All of them said that they would not have noticed your friend if he had not been pointed out to them.

2. He does not know what he would have done if your friend had gone from Capua to Rome.

3. Each of us will go to Rome to-morrow if you promise to help that man.

4. If you were to go with me to Syracuse in four days' time, we should be fortunate.

5. You ought not to have prevented me from carrying out this plan.

6. He would have been able to play (*canere*) beautifully on the lyre (*fides*), if you had taught him music.

7. If he were alive now, he would not hesitate to accuse this wretch of murder.

8. When he saw how affairs stood (*se habere*), he determined to go into exile.

9. He would not have been persuaded by you to stop in the city of Rome if he had known this four days sooner.

QUERY COLUMN.

RULES.

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the name and address of the correspondent, and the *coupon* which appears on the back wrapper of the current number of the Journal.
3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

M. Carpentier.—The best series of books to meet your special needs are undoubtedly the Otto-Gaspey-Sauer Series. You should apply to David Nutt, publisher, Strand, for particulars of the French editions.

London Matriculation.—The U.C.C. (W. B. Clive and Co.) issue in their Tutorial Series a very good edition of the book prescribed for January 1901. It is edited by H. H. Allcroft, M.A., and T. R. Mills, B.A., and is arranged in three parts—namely, Part I.: (*a*) Introduction, (*b*) Text, (*c*) Notes. Part II.: (*a*) Test Papers, and (*b*) Vocabulary. Part III. consists of a Translation. The introduction gives a good general idea of the nature of the book.

Ralpho.—1. Find an integral function of x of the first degree whose value is doubled when x is doubled, and which has the value 9 when $x = 3$.

2. Explain carefully what is meant by the solution of a conditional equation containing one or more variables, and show that if all the solutions of $Ax + By + C = 0$ are also solutions of $A^1x + B^1y + C^1 = 0$, then

$$\frac{A}{A^1} = \frac{B}{B^1} = \frac{C}{C^1}.$$

(H.G. Leaving Certificate Papers, 1888.)

1. $ax + b$ is called a *function* of x, because it is an *expression involving* x; it is something whose value alters as that of x alters. For the same reason it might be considered to be a function of a or b. It is an *integral* function, because there are no operations involved which are other than addition, subtraction, and multiplication. It is of the first degree in x, because the *highest* power of x which it contains is the *first*. Let y stand for $ax + b$, then

$$y = ax + b \text{ (1)}.$$
$$\therefore 9 = 3a + b \text{ (2)}, \text{ since } y = 9 \text{ when } x = 3.$$
$$\text{Also } 2y = 2ax + b \text{ (3)}, \text{ putting } 2x \text{ for } x.$$

Multiply (1) by 2 and subtract (3) from the result, thus—

$$2y = 2ax + 2b,$$
$$2y = 2ax + b.$$

Hence, on subtraction,

$$0 = b.$$

Therefore from (2) we obtain $3a = 9$, or $a = 3$, and the required function is $3x$.

2. An equation like

$$5a = 3a + 2a,$$

in which the right-hand side has the same value as the left-

hand side, no matter what the value of a may be, is called an *identity*, or *identical* equation.

One such as

$$3x = 20, \text{ or } 2x + 3y = 54,$$

is called a *conditional* equation, because the two sides are equal only on the condition that x or x and y have *certain* values, but are not equal for *all* values of x and y.

We are said to obtain a solution to a conditional equation, say,

$$2x + 3y = 17a,$$

when we have found such values of the variables x and y that when they are put in the equation we obtain an identity. Thus $x = 7a$, $y = a$, is a solution to the above equation, because

$$14a + 3a = 17a$$

is an identity.

Let a and b be values of x and y which satisfy both the equations—

$$Ax + By + C = 0 \quad . \quad . \quad . \quad . \quad . \quad (1),$$
$$A^1x + B^1y + C^1 = 0 \quad . \quad . \quad . \quad . \quad . \quad (2).$$

Then
$$Aa + Bb + C = 0 \quad . \quad . \quad . \quad . \quad . \quad (3),$$

and
$$A^1a + B^1b + C^1 = 0 \quad . \quad . \quad . \quad . \quad . \quad (4).$$

Dividing (3) by A, and (4) by A^1, we obtain—

$$a + \frac{B}{A}b + \frac{C}{A} = 0,$$

$$a + \frac{B^1}{A^1}b + \frac{C^1}{A^1} = 0.$$

By subtraction—

$$\left(\frac{B}{A} - \frac{B^1}{A^1}\right)b + \left(\frac{C}{A} - \frac{C^1}{A^1}\right) = 0.$$

Now, since b is not necessarily zero, one way in which the left-hand side can be zero is by $\frac{B}{A} - \frac{B^1}{A^1}$ being zero, and *at the same time* $\frac{C}{A} - \frac{C^1}{A^1}$ being zero.

Hence
$$\frac{B}{A} = \frac{B^1}{A^1}, \text{ and } \frac{C}{A} = \frac{C^1}{A^1},$$

or
$$\frac{A}{A^1} = \frac{B}{B^1}, \text{ and } \frac{A}{A^1} = \frac{C}{C^1}.$$

Therefore
$$\frac{A}{A^1} = \frac{B}{B^1} = \frac{C}{C^1}.$$

Another way in which the left-hand side can be zero is by $\left(\frac{B}{A} - \frac{B_1}{A_1}\right)b$ being equal to $-\left(\frac{C}{A} - \frac{C^1}{A^1}\right)$; that is, $\left(\frac{B}{A} - \frac{B^1}{A^1}\right)b = \left(\frac{C^1}{A^1} - \frac{C}{A}\right)$.

Hence
$$\frac{Bb + C}{A} = \frac{B^1b + C^1}{A^1}.$$

Therefore
$$\frac{A}{A^1} = \frac{Bb + C}{B^1b + C^1},$$

and the right-hand fraction can have the constant value $\frac{A}{A_1}$ for all values of b when $\frac{B}{B^1} = \frac{C}{C^1}$.

For example, all values of x and y which satisfy

$$2x + 3y - 4 = 0,$$

will satisfy
$$8x + 12y - 16 = 0,$$

because the lower equation is obtained by multiplying throughout the upper by 4. Here clearly

$$\frac{2}{8} = \frac{3}{12} = \frac{4}{16}.$$

J. B. Holmyard.—Show that

$$\frac{\lfloor 2m}{2^{2m}\lfloor m} = \frac{1 \cdot 3 \cdot 5 \ldots\ldots (2m-1)}{2 \cdot 2 \cdot 2 \ldots\ldots\ldots 2}.$$

(S.K., Math., Stage 3, 1885.)

$$\frac{\lfloor 2m}{2^{2m}\lfloor m} = \frac{1 \cdot \overset{2}{\cancel{2}} \cdot 3 \cdot \overset{2}{\cancel{4}} \cdot 5 \cdot \overset{2}{\cancel{6}} \cdot 7 \cdot \overset{2}{\cancel{8}} \ldots\ldots 2m}{2^{2m} \cdot \underset{2}{\cancel{1}} \cdot \underset{2}{\cancel{2}} \cdot \underset{2}{\cancel{3}} \cdot \underset{2}{\cancel{4}} \ldots\ldots m}$$

$$= \frac{1 \cdot 3 \cdot 5 \cdot 7 \ldots\ldots (2m-1) \cdot 2^m}{2^{2m}}$$

$$= \frac{1 \cdot 3 \cdot 5 \ldots (2m-1)}{2^m}$$

$$= \frac{1 \cdot 3 \cdot 5 \ldots\ldots (2m-1)}{2 \cdot 2 \cdot 2 \ldots\ldots \quad 2},$$

since there are m factors in the numerator.

J. T.—A heat engine working between two temperatures could theoretically convert $\frac{1}{6}$ of the heat supplied into useful work; but if the lower temperature were reduced by 65° C., the theoretical efficiency would be doubled. Find the temperatures.

(S. and A., 1897.)

No doubt the engine is meant to be a *perfect* heat engine, in which case

$$\text{efficiency} = \frac{\text{higher temp.} - \text{lower temp.}}{\text{higher temp.}},$$

the temperatures being absolute.

Hence we have

$$\frac{T_1 - T_2}{T_1} = \frac{1}{6}. \quad \therefore 1 - \frac{T_2}{T_1} = \frac{1}{6}, \quad \therefore \frac{T_2}{T_1} = \frac{5}{6}.$$

Again

$$\frac{T_1 - (T_2 - 65)}{T_1} = 2 \times \frac{1}{6},$$

$$\text{or } 1 - \frac{T_2}{T_1} + \frac{65}{T_1} = \frac{1}{3}.$$

$$\therefore \frac{1}{6} + \frac{65}{T_1} = \frac{1}{3}, \quad \therefore \frac{65}{T_1} = \frac{1}{3} - \frac{1}{6} = \frac{1}{6},$$

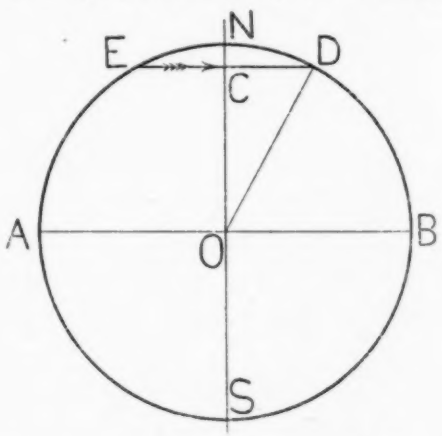
$$\therefore T_1 = 65 \times 6 = 390° \text{ C.},$$

$$\therefore T_2 = \frac{5}{6} \text{ of } 390 = 325° \text{ C.}$$

Measured on the ordinary scale, the temperatures are 390 − 273, or 117° C.; and 325 − 273, or 52° C.

Z.—What distance in space is travelled in an hour in consequence of the earth's rotation by a person situated in latitude 60°? (Earth's radius = 4,000 miles.) (Lock's *Trigonometry*.)

In the figure, N is the north pole, S the south pole, and



AB an edge view of the equator; the angle BOD is 60°, and ED is an edge view of the circle of latitude 60°.

In one day a person situated at a point on this circle will travel a distance equal to the circumference of this circle—namely, $2\pi \times CD$.

$$\text{Now } 2\pi \cdot CD = 2\pi \cdot OD \sin COD = 2\pi \times 4000 \times \frac{1}{2}$$

$$= 4000\pi \text{ miles.}$$

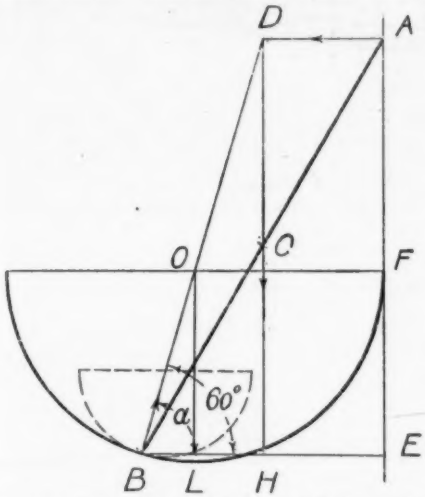
$$\text{In one hour he will travel } \frac{4000\pi}{24} = \underline{523{\cdot}6 \text{ miles.}}$$

In the solution to query given in November PRACTICAL TEACHER, NMP is the right angle.

J. Purdie.—A smooth hemispherical bowl of diameter a is placed so that its edge touches a smooth vertical wall. A heavy rod is in equilibrium, inclined at 60° to the horizon, with one end resting on the inner surface of the bowl, and the other end resting against the wall. Show that the length of the rod must be $a + \frac{a}{\sqrt{13}}$. (Ex. 8, p. 54, Loney's *Mechanics and Hydrostatics*.)

1. The three forces which keep the rod in equilibrium are: (1) the weight of the rod acting through the middle point G; (2) the reaction from the wall at A acting at right angles to the wall; (3) the reaction from the surface of the hemisphere

at B acting through B and the centre O. The lines of action of these forces must meet at a point. We have ensured this



at D—that is, in drawing our figure we have made use of the fact that the rod *is in equilibrium*.

2. The angle ABE is 60°.

Making use of these two conditions, we obtain, l being the length of the rod,

$$BE = \frac{l}{2}, \quad DA = BH = \frac{l}{4},$$

and $$DH = AE = l\frac{\sqrt{3}}{2}.$$

Therefore $$BD^2 = BH^2 + HD^2 = \frac{l^2}{16} + \frac{3l^2}{4} = \frac{13}{16}l^2.$$

$$\therefore BD = l\frac{\sqrt{13}}{4}.$$

$$\therefore \cos\alpha = \frac{BH}{BD} = \frac{1}{\sqrt{13}}.$$

All these results would be true if the hemisphere occupied the dotted position, the wall remaining where it is. But we must make use of the fact that the hemisphere touches the wall at F.

Therefore OB = OF, = LE.

$$\therefore BE = BL + LE, = BL + OF$$

$$= OB\cos\alpha + OB, = \frac{a}{2}\cdot\frac{1}{\sqrt{13}} + \frac{a}{2}.$$

That is, $$\frac{l}{2} = \frac{a}{2}\frac{1}{\sqrt{13}} + \frac{a}{2}. \quad \therefore l = \frac{a}{\sqrt{13}} + a.$$

Bike.—In a given rhombus to inscribe the least possible rhombus. (St. III., Science and Art.)

It is easy to prove that the diagonals of a rhombus intersect at right angles, and divide the rhombus into four triangles equal in every respect.

From considerations of symmetry, an inscribed rhombus will have its centre coincident with that of the given rhombus.

Let O be the centre of the given rhombus.

Draw CA through O. Let CA be one diagonal of the required rhombus, and θ the angle which it makes with FE. This diagonal determines an inscribed rhombus, the area of which will alter as θ alters. Draw BD through O and *perpendicular to* CA; then it may easily be shown that ABCD is a rhombus.

The angle $OBG = \frac{\pi}{2} - (\theta - \alpha)$, because the angles of the quadrilateral CFBO are together equal to four right angles, and BOC is one right angle.

Draw the lines AN, DM perpendicular to FE and FG; then obviously AN = DM.

Diagonal $AC = AN\operatorname{cosec}\theta$.

Diagonal $BD = DM\operatorname{cosec}\left\{\frac{\pi}{2} - (\theta - \alpha)\right\} = AN\sec(\theta - \alpha)$.

Area of inscribed rhombus = 4OAB, $= 4 \cdot \frac{1}{2}$ OB . OA

$$= 4 \cdot \frac{1}{2}\frac{BD}{2}\cdot\frac{CA}{2}$$

$$= \frac{1}{2}AN^2\sec(\theta - \alpha)\cdot\operatorname{cosec}\theta.$$

Since AN is constant, this area will be a minimum when $\sec(\theta - \alpha)\cdot\operatorname{cosec}\theta$ is a minimum—that is, when $\cos(\theta - \alpha)\cdot\sin\theta$ is a maximum.

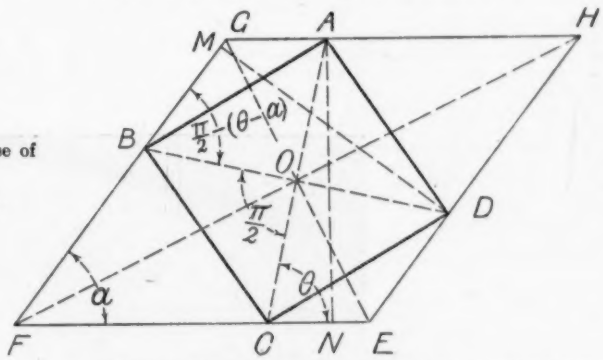
Now $\cos(\theta - \alpha)\cdot\sin\theta = \frac{1}{2}\{\sin(2\theta - \alpha) + \sin\alpha\}$, which is a maximum when $\sin(2\theta - \alpha)$ is a maximum—that is, when $2\theta - \alpha$ is a right angle, or

$$\theta = \frac{\pi}{4} + \frac{\alpha}{2}.$$

When θ has this value,

$$\text{angle } OBG = \frac{\pi}{2} - (\theta - \alpha) = \frac{\pi}{4} + \frac{\alpha}{2}.$$

Hence we obtain the rhombus of least area by drawing the diagonals CA and DB so that they are equally inclined to the sides FE and FG, the angle in each case being half a right angle, together with half the acute angle between two



adjacent sides of the rhombus. The least rhombus happens to be a square.

WHAT SHALL I DO WITH IT?

MR. CARNEGIE'S CONUNDRUM—£40,000,000.

THIS is the title of Mr. Stead's Annual for 1900. A congenial task for Mr. Stead upon which to exercise his fertile and versatile brain. Andrew Carnegie was taken to America at an early age, and at twelve was bobbin boy in a cotton factory. A shrewd and dour Scotch laddie, he soon began to feel his way, and exchanged his work for that of telegraph boy and then telegraph operator. He shortly became interested with Mr. Woodruff, the inventor of the sleeping car; and next veritably "struck oil" when he became part owner of the Pennsylvanian oil-fields.

But Mr. Carnegie's fame, of course, rests upon his "Carnegie Steel Works," the finest in the world. Recognising that steel was the metal of the future, and with a reputation that could command unlimited capital, he began to acquire all the best mineral resources of coal and iron. And hence his wealth. Now he has set himself the problem of how best to dispose of it. Herein comes Mr. Stead's part. The real object of the Annual is evidently to encourage suggestions that may be of help to Mr. Carnegie, the whilom Dunfermline laddie. Can any of our readers help Mr. C. in this terrible task? He is a naturalised American, a thorough Republican, politically; views war with undisguised hatred; is a firm disciple of Herbert Spencer and John Morley—and consequently one need say no more of his religious proclivities; does not believe in charities in the generally accepted terms; has a sincere desire to benefit his fellow-men, and £40,000,000 to back it. Who will help? Remembering always that Mr. Carnegie is the author of that famous epigram, "The man who dies rich dies disgraced."

Mr. Stead gives much information in his Annual, and at the same time finds various opportunities of condemning, not war in general, so much as the South African War and Mr. Chamberlain in particular. But not the least interesting part of his work is his contrast of Andrew Carnegie and Cecil Rhodes.

We must leave our readers to draw their own conclusions from Mr. Stead's reasoning. Probably the majority of readers may consider the Annual somewhat "dry;" but, then, the season may compensate after all.

OUR SCIENCE SECTION

☛ **Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this Number.**

STAR STUDY
FOR SCHOLARSHIP STUDENTS.

III.—FEBRUARY.

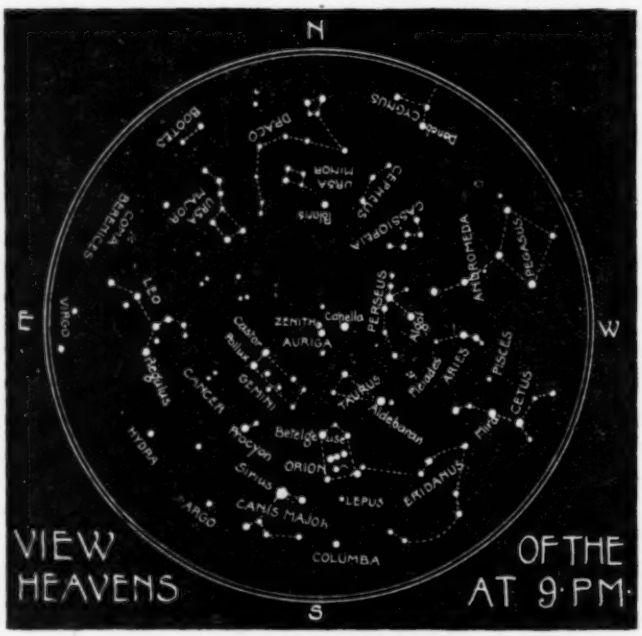
THE student may now give a little attention to the question of why we have (1) circumpolar stars that never rise or set, (2) stars that rise and set, and (3) stars that never rise. In order to understand this, consider an observer in three separate positions, namely—(1) at a pole, (2) at the equator, (3) in middle latitudes.

1. **Observer at the Pole.**—As the earth rotates, the whole of the stars in the celestial hemisphere corresponding to the pole in question will describe circles, but will neither rise nor set.

2. **Observer at the Equator.**—As the earth rotates, the stars rise and set vertically during one complete rotation.

3. **Observer in Middle Latitudes.**—Let the observer be at 51½° N., the latitude of London. Here the north pole is 51½° above the horizon, as the altitude of the pole corresponds to the latitude of a place. As the earth rotates, stars whose distance from the pole is not more than 51½° must remain always above the horizon—that is, they describe circles round the pole star; in other words, they are circumpolar. As the north pole is 51½° above the horizon, the south pole must be depressed 51½° below the horizon; hence stars that are less than 51½° distant from the south pole will never rise above the horizon of London, or of other places in the same latitude. Hence, with respect to stars visible or invisible in mid-latitudes, the rule is as follows:—Stars that are distant from the observer's pole not more than the observer's latitude are circumpolar; stars distant from the opposite pole not more than the observer's latitude never rise above his horizon; stars between these two positions rise and set. The student should study the diagrams in Gregory's *Physiography*, pp. 147–9, and should endeavour to answer the following query, which was set at the Christmas examination:—

An Arctic explorer spends Christmas in 75° N. latitude. For 24 hours he watches the bright "fixed star" Capella, which in latitude 52° N. never seems to set, though it sometimes appears close to the horizon. Describe the movements that the star seems to make. At about what altitude will he see the star (1) *when it is nearest the horizon, and* (2) *when it is highest above the horizon?*



STAR MAP NO. III. (FEBRUARY).

Revision.—The first task this month is to find the thirteen constellations that have already been under study. Of these, Perseus, Auriga, Gemini, and Taurus will be found in the zenith; Ursa Minor is in the north; Ursa Major is in the north-east; Canis Major and Orion in the south; whilst Andromeda, Pegasus, and Aries will be found in the west.

The Zodiacal Constellations (continued).—Of these, Aries, Taurus, Gemini, and Cancer have been located already. Next in order comes **Leo.** To find Leo, a line is drawn through the pointers, but *away* from Polaris. This line conducts to the part of Leo which is called the Sickle, and composed of five stars—namely, α, γ, δ, θ, and β—the first named being a bright star of the first magnitude, known as Regulus; γ, δ, and β being of the second magnitude. Leo is famous as the radiant of the great November shower of meteors—that is, the point in the heavens from which the Leonids, as they are called, radiate. The sun reaches the point in his path that is marked by Regulus on the 21st August of each year. **Virgo** may be found by producing the line through α and γ Ursæ Majoris on the opposite side to Perseus. The most striking object in the constellation is the first-magnitude star **Spica,** which, again, furnishes a ready means to the identification of the group, since, with Arcturus and β Leonis, it forms a conspicuous equilateral triangle. Scorpio, Sagittarius, Capricornus, and Aquarius are not visible; but the remaining zodiacal constellation Pisces is in good position this month for being observed.

Pisces is an insignificant constellation, hardly worthy of notice were it not for the fact that it forms one of the stations in the sun's way. Its brightest member has only a magnitude of 3½. By the aid of the star-map the ecliptic may now be traced through Pisces, Aries, Taurus, Gemini, Cancer, Leo, and Virgo.

The Signs of the Zodiac.—Two thousand years ago, the sun, at about the 20th March—that is, at the vernal equinox, or the day in spring when day and night are exactly equal in length—entered the constellation Arics; and a month later, having traversed 30° of the ecliptic, he entered the constellation Taurus; and so on for the whole year there was a zodiacal constellation for each season and for each month. In consequence of the precession of the equinoxes—to explain which is beyond our province—the sun has to go through less than a complete circle (less by 50″ each year) before he again enters the constellation Aries; hence the vernal equinox now no longer corresponds with the appearance of the sun in the constellation Aries; but so accustomed have men become to the usage begun two thousand years ago, that we still speak of the sun as being in Aries at the vernal equinox, although he is really in Pisces, and does not enter the constellation Aries until a month later. We therefore speak of the sun at the vernal equinox as being in the **sign** Aries, which does not correspond with the constellation of the same name. For the

same reason the sign Capricornus is associated with the month of January, although the sun is in the constellation Sagittarius, and in another two thousand years will be in Scorpio.

Hence, although we associate February with the signs Aquarius and Pisces, he is really in Capricornus. It is very necessary that this distinction between zodiacal sign and constellation should be well understood.

NOTES ON ADVANCED AND HONOURS PHYSIOGRAPHY.

The Darjeeling Landslips.—Writing to *Nature*, Mr. T. H. Holland, of the Geological Survey for India, who personally inquired into the causes of the Darjeeling landslips on the spot, and immediately after the occurrence, gives a very clear account of the disaster, which is exactly on all-fours with many other notable landslips, such, for example, as that which gave rise to the famous Undercliff in the Isle of Wight. "The unprecedented rain," he writes, "which accompanied the September cyclone was a sufficient and satisfactory immediate cause for the numerous landslips near and in Darjeeling. Up to the morning of the 23rd the monsoon rains measured some 17 inches in excess of the average for previous years, and the thick soil-cap was already saturated. The cyclonic depression, first reported by the Meteorological Department to be formed to the north-east of False Point in the Bay of Bengal, moved northwards until its centre on the 24th had reached latitude 25°, causing heavy rain over most of the province. During the twenty-four hours ending at 8 a.m. on the 23rd, 5·31 inches of rain fell at Darjeeling, followed by 19·4 inches during the next twenty-four hours. Of the latter amount, 14·32 inches fell between 4 p.m. on the 23rd and 4 a.m. on the 24th, being thus **over an inch an hour for a stretch of twelve hours.** It was during this last period, when the rainfall was at its heaviest, that the disastrous slips occurred. ..... In Darjeeling the slips were confined entirely to the soil-cap, which ran down the steep hillsides as rivers of mud, and, with occasional included boulders, bombarded the back quarters of most of the houses."

The Great Salt Lake and Marine Fauna.—For many years attempts have been made to acclimatise the oyster in the least salt portions of the Great Salt Lake; but all such attempts have failed, simply on account of the greater proportion of saline matters in the Utah lake as compared with the sea. The density of the waters of the Great Salt Lake is 1·168, whereas that of the ocean is only 1·025; and it has been found that marine organisms require a water whose brackishness gives it a density of between 1·010 and 1·020. It is interesting to note that the substances present in solution in the case of the Great Salt Lake are not only the same as those present in the waters of the ocean, but also they are present in the same relative proportion—common salt being about three-fourths of the total dissolved matter in each case. About 42,000 tons of common salt are annually recovered from this great lake, but so small is this in proportion to the total amount held in solution, that 14,000 years must elapse before the salt recovery processes reduce the density of the water to 1·068; hence it is evident that, save and except a few hardy diatoms, the waters of the Great Salt Lake must remain destitute of all forms of life.

Displacements due to Earthquakes.—The Indian earthquake of June 1897, in the neighbourhood of the Khasi and Caro Hills, has had considerable effect upon the surrounding land area. With the view of ascertaining exactly the amount of this effect, the officers of the Indian Survey have recently made new triangulations at thirteen different stations. As a result they find that the whole of the area has suffered more or less. The average horizontal displacement appears to be 7 feet, whilst the changes in height vary from a subsidence of 4·3 feet to an upheaval of 24 feet. These changes, however, it must be observed, are only relative; so that whilst it must be conceded that both upheaval and subsidence have taken place within the area, the absolute amount of upheaval and subsidence is yet to be determined.

The Piscian Stars.—A memoir on the Piscian stars—that is, those in the spectra of which there are dark flutings of carbon—has been contributed to the Royal Society by Sir Norman Lockyer, who gives the following summary of his memoir in *Nature*:—

1. The undoubted presence of carbon flutings in the sun, and of solar lines in the Piscian stars, indicates that these latter are next in order of development of the Arcturian stars.

2. The stars observed by Dunés may be divided into seven species, beginning with the hottest and ending with the coolest.

3. The reported presence of bright lines in the Piscian stars must be received with caution, as similar evidence of bright lines might be adduced in the case of other classes of stars in which the spectrum is fully explained by dark lines alone.

4. The redness of the stars increases as we pass from the earlier to the later species of the group.

5. The variability in this group is less marked than in the Arcturian stars, and may perhaps be accounted for by the revolution of secondary bodies of the nature of comets round their primaries.

6. The place on the temperature curve assigned to these stars on the meteoritic hypothesis is fully confirmed by the more detailed inquiry, and the hypothesis is thereby strengthened.

Glacial Drifts.—In the recently published account of the work of the Geological Survey of Great Britain there occur, under the head of the Pleistocene observations, some interesting remarks touching the carrying action of glaciers in this and other geological periods. Concerning the glacial drifts near Uttoxeter, it is remarked that the prevalent drift of the higher ground is a red sandy loam, or more rarely clay, containing numerous rounded quartzite and other pebbles, mainly derived from the bunter. Evidence was obtained that in spite of its general resemblance to rain-wash, the material is the local equivalent of the true boulder clay, and has had a similar derivation from the moving mass of land-ice by which the whole country has been covered. It is remarked that the movement of the ice has not been determined by the shape of the ground in the vicinity, nor by the presence of the elevated Carboniferous limestone tract of the Weaver Hills, but has been consequent upon the pressure of the great ice-sheet which was piled over the lower ground to the westward and to the north-westward. The occurrence in new localities of marine shells in the drift of North Staffordshire is likewise recorded. Further particulars are also given of the glacial drift in South Wales. The height to which this extends seems limited only by that of the ground. Not only till with glaciated boulders, but numerous striated rock surfaces have been observed, at heights varying up to 2,000 feet, in the Old Red Sandstone. In the Isle of Man the glacial series has been found by a deep boring to be of unusual thickness, apparently descending to between 470 and 500 feet below sea-level.

In Scotland.—In Aberdeenshire there is evidence of the occurrence of blocks of the Glen Derry diorite more than six miles from the parent mass. These blocks could not have been brought by the later or local glaciation, but must have been transported by the ice-sheet over ridges nearly 3,000 feet high. In Inverness the high-level terraces of pluvio-glacial gravel have been traced to an elevation of 1,000 feet. In Skye it has been shown that at the epoch of maximum glaciation, only the summits of the Cuillins stood above the ice, which is also true of the Beaver and probably of the Red Hills, the crumbling granite of which, however, is not so well adapted as is gabbro to retain the marks of glaciation.

CHEMISTRY NOTES.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
First Class Honourman in Chemistry.

Occlusion of Hydrogen by Ni, Co, Cu, and Ag.—Mr. Baxter has studied the occlusion of hydrogen by these metals, and finds that, although hydrogen is absorbed in all cases, it is noteworthy that when the metals are reduced from their pure oxides at low temperatures, the magnitude of the occlusion varies with the fusion point of the metals. Cobalt, whose melting point is the highest, occludes by far the greatest volume of the gas; whilst silver, which melts at the lowest temperature, occludes minimum quantities. The sintering or fusing together of the metals is greater the nearer the reduction temperature is to their melting points, while the surface offered, which determines the amount of occlusion, diminishes with the amount of sintering.

Since the melting points of Cu and Ag are very near together, one would expect their power of occlusion to be very nearly the same, and this is the case.

Pure ferric oxide is not reduced to any considerable extent by hydrogen at the low temperature employed in the case of the four preceding metals. When a temperature of sufficient height to produce reduction is employed, no appreciable amounts of hydrogen are occluded, because of the sintering of the metal. On account of this difficulty, no work could be done with iron comparable with that done with the other four metals.

Absorption or Combination?—The question as to whether compounds of hydrogen with the metals are formed similar to the hydrogenium that is formed when hydrogen is occluded by palladium has not yet been settled. On the one hand, the quantity occluded varies according to the amount of surface exposed, which points to simple condensation at the surface, and not to combination. On the other hand, the difficulty of freeing the hydrogen from the metals in a vacuum, when cold, suggests combination rather than mere absorption.

The Concentration of H_2SO_4 in Cast-Iron Vessels.—Platinum is greatly increasing in price; hence the employment of platinum vessels for the concentration of H_2SO_4 threatens to become a very burdensome item in the plant. To remove this expensive item, Herr Hartmann proposes to use cast-iron vessels for the condensation in place of platinum.

Acid at 54° to 55° Baumé is placed in lead receivers, in which it is concentrated to a density of 61° Baumé. It here attains a temperature of 145° to 150° C., and at this point it is run into a small cast-iron dish; it there reaches a temperature of about 180° C., and a strength of about 64° B. It is then run into the two actual concentrating vessels made of cast-iron, and arranged in the form of a cascade. The acid from this apparatus has a strength of from 97 to 98 per cent. of monohydric sulphuric acid. That the quantity of iron absorbed by the acid is not serious, when a pure acid is not required, is evident from the following figures. A sample of acid at 66° B. contained 95·4 per cent. H_2SO_4, and only 0·015 per cent. Fe_2O_3; another sample from the same source contained 97·1 per cent. H_2SO_4, and 0·010 per cent. of Fe_2O_3. It is highly probable that these cast-iron concentrating vessels will become universal, especially if the present upward tendency in the price of platinum continues.

The Reaction between H_2SO_4 and $K_4FeC_6N_6$.—Messrs. Adie and Browning have had this reaction under study. They find that the salt dissolves in acids of strengths corresponding to H_2SO_4 (98 per cent.) and $H_2SO_4H_2O$, with the formation of potassium sulphate and hydroferrocyanic acid; there is only a slow and incomplete formation of carbon monoxide.

With acid of the strength represented by $H_2SO_42H_2O$, the decomposition of the salt results in the formation of carbon monoxide; this reaction accounts for all the cyanogen in the salt. With more dilute acid, of the composition of from $H_2SO_44H_2O$ to $H_2SO_410H_2O$, the products are hydrocyanic acid and Everitt's salt ($K_4Fe_2C_6N_6$). Beyond the latter dilution all the cyanogen in the compound appears as hydrocyanic acid; while the formation of carbon monoxide probably ceases with acid of $H_2SO_44H_2O$ strength.

The authors discuss the mechanism of the reaction (1) through the formation and hydrolysis of hydrocyanic acid by means of the dilute sulphuric acid; (2) through the reaction of the potassium sulphate first formed on the hydrocyanic acid, with the immediate formation of Everitt's salt. The latter reaction only takes place in fairly concentrated solutions, whilst the former alone occurs with acids more dilute than that represented by $H_2SO_410H_2O$.

SCIENCE NOTES.

New Methods of Anthropological Research.—Attention has lately been called by Dr. W. H. R. Rivers to two new methods of anthropological investigation invented by him. The first is the colour-wheel. Leribond's tintometer, which has been of great use in matching colours, is not very suitable for matching skin colours. There is only one objection to the colour-wheel: the paper discs are liable to fade, and therefore one cannot be certain that any two issues of coloured discs will be of exactly the same tint. By having a large number of discs, the original records can be filed for future reference, and they will not fade if they are kept in the dark. If permanent and absolutely comparable discs can be produced, the colour-wheel may be regarded as a quite satisfactory method of investigation. Dr. Rivers's second method is an important sociological one. It consists in accurately recording the genealogies of all the individuals of an island or limited community for as far back as the informants can remember. In a totemistic people the totems should be also recorded, for this yields evidence as to marriage restrictions. Definite statistics are also furnished as to the size of families, the proportion of sexes, the number of early deaths, the prevalence of adoption, and other sociological data.

Electric Pictures.—A German scientist, Herr Fomm, has recently succeeded in obtaining pictures of the sections of different kinds of wood by means of electricity. The section is first covered with tinfoil on the one side and bromide paper on the other, the film being next the wood. A metal point, charged negatively by an influence machine, is then fixed at a distance of five centimetres from the paper, and in about thirty seconds the electricity of the point produces a good impression of the wood.

A New Fog-Signal.—A new fog-signal has lately been tried at Faulkner's Island, Connecticut. It consists of a megaphone, or speaking-trumpet, which is seventeen feet long, and seven feet wide at the mouth, and an inch and a half steam-siren to emit the sound-signal. As these are mounted on a turntable, signals can be sent by the new method to any point of the compass. The invention is designed to send the fog-signal in particular directions, so that a vessel that is nearing the coast can only hear it when it is in line with the axis of the megaphone. American experiments have shown that an observer can hear the signals, when in line with the trumpet, as far as ten miles away; but off that line they cannot be heard as far distant as one mile from the apparatus.

The Largest Zoological Garden in the World.—The largest zoological garden in the world is South Bronx Park, New York. While the Berlin zoological garden, which is the largest in Europe, covers about sixty acres, the New York garden is more than four times its size, comprising, as it does, 261 acres. It is proposed to establish a zoological garden in Edinburgh.

A New Substitute for Indiarubber.—The number of purposes for which indiarubber is used, and its limited supply, have led to the invention of a substitute for it called "velvril." It is made of nitrated linseed or castor oil, mixed with nitro-cellulose. The inventor, Mr. W. F. Reid, proposes to use it for insulating submarine cables, belting, portmanteaus, camping sheets, horse-cloths, floor-cloths, leather, hose, and tubing. The demand for indiarubber is also causing the cultivation of the mangabeira, or cow-tree indiarubber tree. This rubber is nearly as good as the best Para rubber. Its native habitat is Bahia and Pernambuco, and it is thought very suitable for cultivation in the red soil of Usambara, Togoland, and the German colonies of Africa.

The Abolition of the Guillotine.—The process of putting criminals to death by electricity has not met with much approval in England. In France the Government is considering the question of abolishing the guillotine and substituting electrocution by means of a helmet. Two needles in the helmet pierce the temples when the current is put on, and so rupture the brain. The process is thought to be painless. It is to be hoped that it will be more uniformly successful in its action than the method of inhalation of hydrocyanic gas, lately devised by Professor Willis G. Johnson of the Maryland Agricultural Experiment Station. While he only felt, on inhaling the fumes, a pleasant drowsiness and relaxed muscles, Mr. E. Murray-Anson, under the same circumstances, felt "intense intercostal agony, unthinkable mental distress, and a horrible consciousness of all that was going on, without the power to give any sign of life."

The Preservation of Wood.—A new process of preserving wood has lately been invented by a Russian, M. Karitschkoff. It is injected with salts of copper. The copper salt is first dissolved in ligroin, a naphtha product, and is then forced into the dried wood under pressure. The solvent is then driven out by hot air.

Self-Playing Organs.—A self-playing attachment to the organ comes from America. It is called the "maestro," and can be fitted over the keyboard of any organ. The inventor is Mr. L. B. Doman.

Armoured Glass.—"Armoured glass" is a glass plate cast with wire meshes inside. It only cracks under pressures which will break plate-glass, and will bear a pressure of 3,601 lbs. on the square inch.

The Registration of the Chronometer.—M. Alphonse Berget has recently devised a method of registering the behaviour of the chronometer graphically. A delicate Hughes microphone is placed on the instrument, which is connected in circuit with a battery of eight block cells and a telephone whose vibrating plate carries a microphone transmitter with four carbons, which is connected in circuit with four dry cells and a large telephone whose plate makes and breaks an electric contact at each vibration. The contact is made with a carbon point resting on platinum fixed to the plant. The interruptions of this last circuit actuate an electro magnet, and record the beats of the chronometer escapement on a smoked cylinder. By the record thus obtained, the march of the chronometer may be compared with that of a clock registered on the same cylinder to follow the march of a chronometer submitted to heat or cold and barometric pressure. M. Berget's method will register the march of an astronomical clock without interfering with its mechanism, the Hughes microphone having only to be fixed on the pendulum case.

DIFFERENTIAL AND INTEGRAL CALCULUS FOR BEGINNERS.

MAXIMA AND MINIMA (*continued*).

Problem.—A person in a boat 3 miles from the nearest point of the beach (which is supposed to be straight), wishes to reach a place 5 miles from that point along the beach in the shortest possible time. Supposing he can row at the rate of 4 miles per hour, and walk at the rate of 5 miles per hour, at what point on the beach should he land?

Let P (Fig. 1) be the initial position of the boat, at a distance

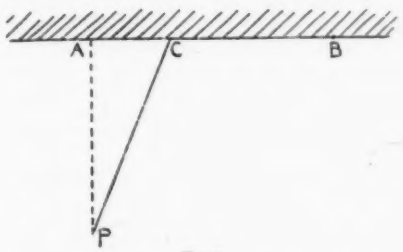


FIG. 1.

PA = 3 miles from land, and let B be the point, 5 miles from A (that is, AB = 5), which he wishes to reach. It is plain that he should row to some point C between A and B, and then walk from C to B, if he wishes to reach B in the shortest possible time.

Let t be the time required to reach B by the route PCB.

Let distance CB = x.

Then distance AC = $(5 - x)$ miles.

$$\text{Distance PC} = \left\{ 3^2 + (5-x)^2 \right\}^{\frac{1}{2}} = (9 + 25 - 10x + x^2)^{\frac{1}{2}}$$

$$= (34 - 10x + x^2)^{\frac{1}{2}}.$$

$$\text{Time required to walk distance CB} = \frac{x}{5}.$$

$$\text{Time required to row distance PC} = \frac{(34 - 10x + x^2)^{\frac{1}{2}}}{4}$$

Time required to reach B by route PCB

$$= t = \frac{x}{5} + \frac{(34 - 10x + x^2)^{\frac{1}{2}}}{4}.$$

For t to be a minimum, $\frac{dt}{dx} = 0$.

$$\therefore \frac{dt}{dx} = \frac{1}{5} + \left(\frac{1}{2} \times \frac{1}{4} \times \frac{2x - 10}{(34 - 10x + x^2)^{\frac{1}{2}}} \right) = 0.$$

$$\therefore 8(34 - 10x + x^2)^{\frac{1}{2}} = 5(10 - 2x).$$

Squaring, we get

$$64(34 - 10x + x^2) = 25(100 - 40x + 4x^2)$$

$$= 2500 - 1000x + 100x^2.$$

Collecting similar terms, we get

$$36x^2 - 360x + 324 = 0.$$

Dividing through by 36, we get

$$x^2 - 10x + 9 = 0.$$

Factorising, we finally obtain

$$(x - 1)(x - 9) = 0.$$

The solutions are—

$$x = 1, \text{ and } x = 9.$$

A glance at Fig. 1 will show that $x = 9$ cannot be a solution of the problem, since the point C would then be to the right of B. Hence, finally, $x = 1$ gives the required result—that is, the man must row directly to a point 1 mile from his destination, and walk the remainder of the way.

The student may be left to prove that the result obtained is a minimum, and not a maximum, value of t.

Example.—Find the condition that, in figure given last month, the sum of the distances OA and OB should possess the smallest possible value.

Ans. Distance $OA = a + \sqrt{ba}$.

$$\text{Tan } \theta = \sqrt{\frac{b}{a}}.$$

Problem.—It is required to cut a beam of rectangular section from a tree-trunk of circular section, subject to the condition that the beam shall be the stiffest possible under the circumstances. Determine the dimensions of the section of the beam.

FIG. 2.

The stiffness of a beam varies inversely as the depression produced at the middle of the beam by a weight of 1 lb. placed there. In other words, if a beam which is straight when supported near its ends (Fig. 2) takes up the position indicated by the dotted lines when a load of w lbs. is suspended from its middle point, the depression at the centre being d, then stiffness of beam = 1 ÷ depression of middle point per lb. suspended = $\frac{1}{\frac{d}{w}} = \frac{w}{d}$.

In order to obtain a beam of maximum stiffness, we must arrange that d has the smallest possible value, or that d should be a minimum.

It can be proved, and will be proved in these columns at a later date, that d varies inversely as the product of the breadth into the cube of the depth of the beam.

Let r be the radius of the circular section of the tree-trunk.

Let B = breadth of the beam.

Let D = depth of the beam.

EFGH represents the required section of the beam.

We have $d \propto \frac{1}{BD^3}$.

d must possess a minimum value, and therefore BD^3 must possess a maximum value.

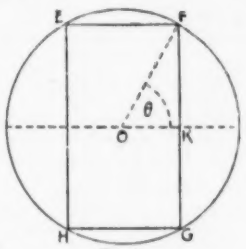


FIG. 3.

Let O (Fig. 3) be the centre of the circular section of the trunk, and let OK be drawn perpendicular to the side FG of the rectangle EFGH. Draw the radius OF, and let the angle FOK = θ.

Then FG = D = 2 × OF sin θ = $2r \sin \theta$.

EF = B = 2 × OF cos θ = $2r \cos \theta$.

$\therefore 2r \cos \theta \times (2r \sin \theta)^2$ must be a maximum.

$\therefore 16r^4 \sin^2 \theta \cos \theta$ = maximum.

From the nature of the problem r must be constant.

Let $y = \sin^2 \theta \cos \theta$. Then, for a maximum value of y,

$$\frac{dy}{d\theta} = 0.$$

$$\frac{dy}{d\theta} = 3 \sin^2 \theta \cos^2 \theta - \sin^4 \theta = 0.$$

$$\sin^2 \theta = 3 \cos^2 \theta.$$

$$\therefore \sin \theta = \sqrt{3} \cos \theta,$$

$$\tan \theta = \sqrt{3},$$

and $2r \sin \theta = \sqrt{3} \times 2r \cos \theta$.

$$D = \sqrt{3} \times B.$$

Since $\tan \theta = \sqrt{3}$, $\theta = 60°$.

The above conditions are sufficient to determine the required dimensions of the section.

It may easily be seen that the result obtained applies to a maximum and not a minimum value of y.

For when $\frac{dy}{d\theta} = 0$, BD^3 must possess either a maximum or minimum value.

As θ is taken more and more nearly equal to 0, the value of D decreases indefinitely, whilst B approaches the limiting value r. Therefore for $\theta = 0$,

$$BD^3 = 0.$$

Also, when $\theta = \frac{\pi}{2}$, D = r, B = 0. Therefore for this value of θ also, $BD^3 = 0$.

BD^2 can never possess a negative value, from the nature of the problem. Consequently, as

$BD^2 = 0$ when $\theta = 0$,

$BD^2 = 0$ when $\theta = \frac{\pi}{2}$,

BD^2 = positive value for intermediate values of θ.

BD^2 must at first increase in value as θ is increased from zero upwards, and must subsequently decrease as the value $\theta = \frac{\pi}{2}$ is approached. Hence there must be a maximum value of BD^2 between the values $\theta = 0$ and $\theta = \frac{\pi}{2}$. This maximum value is given, as shown above, by the condition $\theta = 60°$.

ELECTRICITY AND MAGNETISM.

BY EDWIN EDSER, A.R.C.S., F.PH.S.

The Metre Bridge (*Continued*).

To determine the correction for errors due to imperfect soldering of the bridge wire.—If the bridge wire is imperfectly soldered at its ends, a definite resistance will be introduced at each of those points. The effect of the resistances so introduced will be the same as if the wire were lengthened more or less at its ends. Hence the problem before us is to determine the amount by which the bridge wire must be considered to be lengthened at either end, and the results so obtained can be used in our subsequent measurements.

The two end gaps on the bridge are closed with their copper connecting pieces, and two standard resistance coils are placed in the interior gaps. Let these resistances be respectively equal to R_1 and R_2 (Fig. 1).

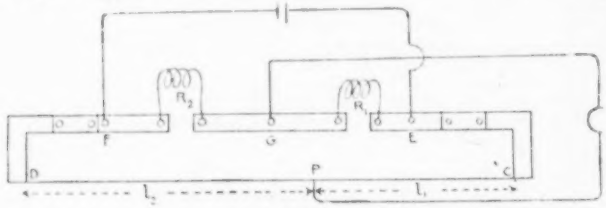


Fig. 1

Connect the galvanometer and cells to the bridge in the manner previously detailed, and find the position at which, when contact is made on the bridge wire, no deflection of the galvanometer is produced.

Let the distance of this point from the right-hand end of the bridge wire be equal to l_1, whilst the distance of the same point from the left-hand end of the bridge wire is equal to l_2.

Let r be the resistance of unit length of the bridge wire.

Now, owing to the fact that the right-hand end of the bridge wire may have been imperfectly soldered, the distance of the point of equilibrium P should be measured from a point slightly to the right of the point C. In other words, the total resistance in the arm of the bridge between the points E and P is equal to

$$l_1 r + \lambda_1 r,$$

where λ_1 is that length of the bridge wire (considered for the moment to be uniform in sectional area, etc., along its whole length) which would possess an electrical resistance equal to that of the soldered joint.

Similarly, the resistance in the arm of the bridge between the points P and F may be written

$$l_2 r + \lambda_2 r.$$

Now, since the point P is at the same potential as the point Q, we have, as previously explained,

$$\frac{R_1}{R_2} = \frac{l_1 r + \lambda_1 r}{l_2 r + \lambda_2 r} = \frac{(l_1 + \lambda_1) r}{(l_2 + \lambda_2) r} = \frac{l_1 + \lambda_1}{l_2 + \lambda_2} \quad . \quad . \quad . \quad . \quad (1)$$

Now interchange R_1 with R_2, and determine the position of the new point of equilibrium on the bridge wire. Let this point be at a distance l'_1 from C (Fig. 1) and l'_2 from D. Then

$$\frac{R_2}{R_1} = \frac{l'_1 r + \lambda_1 r}{l_2 r + \lambda_2 r} = \frac{l'_1 + \lambda_1}{l'_2 + \lambda_2} \quad . \quad . \quad . \quad . \quad . \quad (2)$$

R_2 and R_1 being known, we thus possess two equations, (1) and (2), from which the two unknown quantities λ_1 and λ_2 can be determined. From (1) and (2) we obtain

$$\left.\begin{aligned} R_1\lambda_2 - R_2\lambda_1 &= R_2 l_1 - R_1 l_2 \\ R_2\lambda_2 - R_1\lambda_1 &= R_1 l'_1 - R_2 l'_2 \end{aligned}\right\} \quad . \quad . \quad . \quad . \quad (3)$$

Solving these simultaneous equations for λ_1 and λ_2, we get

$$\lambda_1 = \frac{R_1^2 l'_1 - R_1 R_2 l'_2 - R_2^2 l_1 + R_1 R_2 l_2}{R_2^2 - R_1^2} \quad . \quad . \quad . \quad (4)$$

$$\lambda_2 = \frac{R_1^2 l_2 - R_1 R_2 l_1 + R_1 R_2 l'_1 - R_2^2 l'_2}{R_2^2 - R_1^2} \quad . \quad . \quad . \quad (5)$$

Example.—In a certain experiment conducted to determine the correction to be applied to observations made with a certain metre bridge, of which the ends were imperfectly soldered, the following data were obtained:—

$$\left.\begin{aligned} R_1 &= 1 \text{ ohm} \\ R_2 &= 10 \text{ ohms} \end{aligned}\right\} \text{(standard coils).}$$

Length of bridge wire $= l_1 + l_2 = l'_1 + l'_2 = 100$ cms.

In first experiment,

$l_1 = 8{\cdot}95$ cms. $\quad \therefore\ l_2 = 91{\cdot}05$ cms.

In second experiment,

$l'_1 = 91{\cdot}55$ cms. $\quad \therefore\ l'_2 = 8{\cdot}45$ cms.

Hence $R_1 R_2 = 10$, $R_1^2 = 1$, $R_2^2 = 100$.

From (4), $\lambda_1 = \dfrac{91{\cdot}55 - 84{\cdot}5 - 895 + 910{\cdot}5}{99} = \dfrac{22{\cdot}55}{99} = {\cdot}23$ cms.

From (5), $\lambda_2 = \dfrac{91{\cdot}05 - 89{\cdot}5 + 915 - 845}{99} = \dfrac{72{\cdot}05}{99} = {\cdot}73$ cms.

Problem.—The readings l_1 and l_2, l'_1 and l'_2, in an experiment similar to the above, are made on a fixed scale of equal parts, placed alongside the wire. If, after performing the above calculations, either λ_1 or λ_2 is found to have a negative value, what would this result signify?

Having determined λ_1 and λ_2 in the manner described above, these results are applied as corrections to all subsequent readings made with the bridge. If the necessary corrections are very large (more than a few millimetres, for example), the wire should be resoldered, zinc chloride being used as a flux: all traces of this substance must be afterwards carefully removed by washing.

To make a one ohm coil.

Materials required.—One wooden spool (such as used for winding thread on), two terminals, a quantity of double silk-covered platinoid or manganin wire, of which the resistance is about one ohm per yard; a quantity of paraffin wax, standard ohm coil, metre bridge, galvanometer, and battery (Leclanché cell).

Method.—Bore two holes through points near the opposite ends of a diameter of one end of the spool, the size of these holes being such that the shanks of the terminals will screw *tightly* into them. Fix the terminals in position by screwing (Fig. 2).

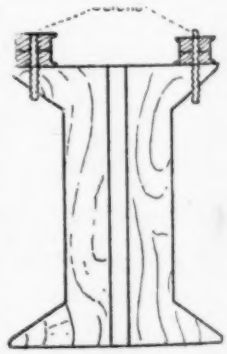


Fig. 2.

Take a length of the manganin or platinoid wire, slightly greater than one metre, remove the silk covering from the ends, and bend the wire at right angles at two points exactly one metre apart. Clamp the bent parts of the wire in the terminals on either side of one of the interior gaps of the metre bridge, join the standard one ohm coil by means of thick connecting wires to the terminals on either side of the other interior gap, and close the end gaps with the copper connecting pieces. Measure the resistance of the length of wire, and calculate the length required to give exactly one ohm resistance.

Solder two points, at the distance apart from each other so obtained, to the projecting ends T_1, T_1 of the terminals (Fig. 2). If zinc chloride is used as a flux, all traces must eventually be carefully washed away with warm water. If resin is used, care must be taken that the solder has formed a good connection with the metals. It is well to solder the extremities of the wire and the projecting ends of the terminals separately, using an ordinary soldering bit. On placing an extremity of the wire in contact with the projecting end of one of the terminals, and touching the junction with the hot soldering bit, previously charged with solder, a perfect joint will generally be obtained.

After soldering the two ends of the wire to the terminals, let the whole become cool, and then measure the resistance between the terminals, using thick wires or strips of copper to connect

these with the terminals at opposite sides of the gap in the bridge. If the resistance so obtained is not exactly equal to one ohm, unsolder one end of the wire and resolder at another point, and repeat the above procedure. By this means the resistance of the coil may be adjusted to be very slightly greater than one ohm.

When this adjustment has been made as perfectly as possible, measure the exact resistance of the coil. If a piece of fine wire of a suitable length is then joined in a parallel with the thicker wire already used across the terminals T, T (Fig. 2), the resistance of the coil can be diminished slightly. To find the resistance of the thin wire to be thus added, we have the following equation:—

$$1 = \frac{1}{R} + \frac{1}{r},$$

where R is the resistance of the coil (adjusted as far as possible, and slightly greater than one ohm), and r is the resistance of the shunt of fine wire.

$$\therefore r = \frac{R}{1 - R}.$$

Cut off a metre length of fine, double silk-covered platinoid wire, measure its resistance, and from this calculate the length necessary to give a resistance equal to r, the value just found. Cut off this length, and solder its ends to the terminals T, T, taking care that the soldering of the thick wire is not disturbed.

Wind the wire, doubled on itself, round the thin part of the spool, binding the doubled end to the spool by a piece of silk thread. Wind a piece of cartridge paper several times round the spool, so as to enclose the wire inside a paper cylinder. Fill the space between this paper cylinder and the central part of the spool with melted paraffin wax. When this has cooled, the paper may be unwound and the paraffin trimmed, when the coil will be completed.

MATHEMATICS.

STAGES 2 AND 3, SCIENCE AND ART DEPARTMENT.

BY G. A. BAXANDALL,

Assistant, Mathematical and Mechanical Division, Royal College of Science, London.

Stage 2.

Algebra.

Simultaneous Equations of the Second Degree.—Read from one of the following text-books:—

C. Smith, chap. xvi.
Hall and Knight, chap. xxvi.
H. Smith, chap. xx.
Todhunter and Loney, chap. xxv.

The student should try to form clear notions as to the meanings of certain terms which are in general use.

An equation of *first degree* is one which contains no term of a higher degree than the *first*. Thus $3x = 10$, $2x + 3y = 8$, $x + 2y + 3z = 10$ are all of the first degree.

In the equation $2x + 4xy + 3y = 8$, the term $4xy$ is said to be of the *second* degree in x and y.

An equation of the *second* degree is one which contains no term of a higher degree than the *second*. Thus $x^2 + 2x = 1$, $xy = 4$, $x + 3xy + y^2 = 4$ are all of the *second* degree.

And, generally, the degree of any equation is the same as that of the term of highest degree.

An equation like $3x^2 + 4xy + 2y^2 = 0$ is said to be *homogeneous*, because every term is of the *same* degree, in this case the *second*.

An equation like $3x^2 + 4xy = 5$ is said to be *homogeneous*, so far as the terms in x and y are concerned.

The student is supposed to be familiar with the method of solving two simultaneous equations when each is of the first degree. Thus, to solve the equations

$$3x - 4y = 7, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$3y + 2x = 8, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

we obtain from the first

$$x = \frac{(7 + 4y)}{3} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Substituting this value of x in equation (2), we obtain

$$3y + \frac{2}{3}(7 + 4y) = 8,$$

which is a simple equation containing y only.

Now, this *method of substitution* is the one which the student must always be ready to use when solving simultaneous equations, even if one of the equations is of a higher degree than the first. And it can always be used *when one equation is of the first degree*. It should also be observed that when both equations are of the second degree, some *special* method is necessary; but as a rule, whatever step be taken, the object is to obtain an equation of the first degree, after which the method of substitution may be adopted.

The student had better notice that when the equations are both of the second degree, they are generally so framed that a solution is obtained by some *tricky* method, such as—(1) adding the two equations together; (2) subtracting one equation from the other; (3) adding something to both sides of one equation with the object of making one side a perfect square; (4) resolving one side of one equation into factors; (5) dividing one equation by the other, so to speak; and so on. With a little practice one becomes accustomed to adopting such methods.

Work many examples selected from the sets provided in the text-book.

Also work the following problems:—

1. Two passengers have together 5 cwt. of luggage, and are charged for the excess above the weight allowed 5s. 2d. and 9s. 10d. respectively. If the luggage had all belonged to one of them he would have been charged 19s. 2d. Find how much luggage each passenger is allowed without charge.

Ans. 100 lbs.

2. There are two roads to a certain place: one path, across the fields, is 8 miles; and the other, by the highroad, is 11 miles long. A man can ride a bicycle along the latter 10 miles an hour faster than he can walk along the other, and would arrive 52 minutes sooner than by walking. What is his rate of walking?

Ans. 5 miles per hour.

3. A person has a hours at his disposal. How far may he ride in a coach which travels b miles an hour, so as to return home in time, walking back at the rate of b^1 miles an hour?

Ans. $\frac{abb^1}{b + b^1}$ miles.

4. A man walks at the rate of 3½ miles an hour to catch a train, but is 5 minutes late. If he had walked at the rate of 4 miles an hour, he would have been 2½ minutes too soon. Find how far he has to walk.

Ans. 3½ miles.

Trigonometry.

The average student does not trouble himself much when studying a branch of mathematics, say trigonometry, with regard to what is and what is not *fundamental*. The latter term is meant to refer to the nature of those facts and truths which should form part of one's mental machinery—things which should be *learned* in the same sense that the multiplication tables are learned. When a student acquires the habit of sorting out such facts, progress will become easy and rapid if he is at all industrious. As he comes to new matter he will naturally ask, "Is this really different from what I have already learned, or does it depend on something which I already know?"

It may be well to take a glance over the ground we have already covered in trigonometry, and ask what is fundamental.

1. The meaning of a *degree* and *radian*: the value of the ratio of circumference of a circle to the diameter.

2. The definitions of the trigonometrical ratios of an angle of *any* magnitude, with the signs + and − which are attached to their numerical values, by agreement. These really include—

$$\tan\theta = \frac{\sin\theta}{\cos\theta}; \ \sec\theta = \frac{1}{\cos\theta}; \ \operatorname{cosec}\theta = \frac{1}{\sin\theta}.$$

3. The fundamental relation—

$\sin^2\theta + \cos^2\theta = 1$, and $\therefore \sin^2\theta = 1 - \cos^2\theta$; $\cos^2\theta = 1 - \sin^2\theta$.

4. In the triangles whose angles are 45°, 45°, 90°, and 30°, 60°, 90°, the sides are in the ratios of 1, 1, $\sqrt{2}$, and 1, $\sqrt{3}$, 2. These are certainly useful facts to know, because text-books and examiners rely on them for furnishing numerical examples. Knowing these, it is not necessary to remember the values of the ratios for these angles and others which in a sense reduce to these. A teacher should have some pity for a student who says that he has *forgotten* the value of sin 60°, or cos 150°, or tan 225°. He ought never to *learn* them, because he should be in a position to rediscover them every time he requires them. In the same way, it is really absurd to load the memory with such facts as, "For angles between 90° and 180° the sine is positive, the cosine and tangent are negative." A simple figure drawn with care will always furnish such information.

5. There are several relations such as $\sin(90 - A) = \cos A$, $\cos(180 + A) = -\cos A$, which occupy a few pages of the text-book. It is certainly important to know that there are such relations, but it is quite unnecessary to try to *remember* them.

Here, again, a simple figure is all that is required to recall any of these relations.

Work the following examples:—

1. How many radians are there in 120°?

Find the diameter of a graduated circle if the value of each of the divisions on the outer rim is 5 minutes (that is, $\frac{1}{12}$ of a degree), and the distance between successive graduations is 0·1 inch. Ans. 2·095; 11·46 feet.

2. Find the numerical values of all the trigonometrical ratios of an angle θ whose sine is $\frac{12}{13}$, if it is known that θ lies between 90° and 180°.

Ans. $\cos\theta = -\frac{5}{13}$; $\tan\theta = -2{\cdot}4$; $\sec\theta = -2{\cdot}6$; $\cot\theta = -\frac{5}{12}$; $\operatorname{cosec}\theta = \frac{13}{12}$.

3. What values between 0° and 360° may D, E, F have when $\sin D = \frac{1}{\sqrt{2}}$; $\cos E = -\frac{1}{2}$; $\cot F = -\sqrt{3}$?

Ans. D = 45° or 135°; E = 120° or 240°; F = 150° or 330°.

4. Find the sign of cos C − sin C (1) when C = 140°; (2) when C = 314°. Ans. (1) negative; (2) positive.

5. Define the sine, cosine, and tangent of an angle greater than a right angle, using figures.

6. Calculate to the nearest minute the four least positive values of x from the equation $5\tan x + 2 = 0$.

Here $\tan x = -{\cdot}4$. Now use the table of tangents.

Ans. 158° 12′; 338° 12′; 518° 12′; 698° 12′.

Geometry.

Read Props. 1 to 13, Book III. In Hall and Stevens, work Ex. 8 to 13 on Prop. 3, page 156; also Ex. 1, 2, 3, 7, Props. 1 to 13, page 171. In Nixon, work Ex. 2, 4, 7, 15 at the end of Book III.

Stage 3.

Algebra.

Progressions.—Read the following:—Hall and Knight, chaps. iv., v., and vi. Todhunter and Loney, chaps. xxxv., xxxvi., and xxxvii. C. Smith, chap. xvii. Briggs and Bryan, *Intermediate Algebra*, chaps. xiv. and xv.

With regard to progressions, there is little which needs to be remembered. The main things are—(1) an expression for any term, say the rth; (2) a formula for the sum of n terms, or of an infinite number of terms if the series is geometric, with a common factor less than unity; (3) how to find one or more means between two given terms. Indeed, the student need not try to remember the formulæ themselves. The best training is to be had by establishing the formulæ whenever they are required; of this there can be no doubt whatever.

One particular form of series, and the artifice adopted for finding the sum of n terms, should be specially noticed—namely, the series in Hall and Knight, Art. 60; Todhunter and Loney, Art. 429; Briggs and Bryan, Arts. 221 and 222.

Work examples selected from the sets given in the text-books; also the following:—

1. If $ax(x-y) = cz(y-z)$, find the simplest form of $\frac{by(x-y)+cz(x-z)}{ax(x-z)+by(y-z)}$. (1899.) Ans. $\frac{cz}{ax}$.

Hint.—Write $\frac{ax}{cz} = \frac{y-z}{x-y} = k$, and substitute kcz for ax, and $k(x-y)$ for $y-z$. The artifice of obtaining the two equal fractions, and putting each equal to k, is a useful one in many examples.

2. Solve the equations—

(*a*) $x + \frac{1}{y} = a$; $y + \frac{1}{x} = b$.

(*b*) $x^2 + y^2 - x - y = 48$; $x + y + xy = 31$. (1899.)

Ans. (*a*) $x = \frac{1}{2}\left\{a \pm \sqrt{\frac{a}{b}(ab-4)}\right\}$; $y = \frac{1}{2}\left\{b \pm \sqrt{\frac{b}{a}(ab-4)}\right\}$.

(*b*) $x = 7, 3, \frac{1}{2}[-11 \pm \sqrt{-47}]$; $y = 3, 7, \frac{1}{2}[-11 \pm \sqrt{-47}]$.

3. If x be a real quantity, and $y(2x^2+2x+1) = x^2 - 2x - 3$, find the greatest and least values of y. (1899.)

Ans. 1 and − 4.

Trigonometry.

Last month we dwelt on the importance of the formulæ which deal with compound angles. We recommend the student to continue working at examples requiring the use of these formulæ. As a rule the examples are framed with the special object of testing whether a student is able to change, say, from the sum or difference of two sines or cosines to the product of two sines or cosines, or *vice versâ*; or to step from the ratios of an angle to those of the double or half angle. We have selected a few typical illustrations, taken, as a matter of fact, from the papers of the last examinations in this stage.

1. If $\cos\beta \tan x = \sin\alpha$, show that

$\cos(\alpha-\beta)\cos(\alpha+\beta)\tan 2x = \sin(\alpha-\beta) + \sin(\alpha+\beta)$.

Hint.—Working with the left side only, express the product of two cosines as the sum of two cosines, and for $\tan 2x$ write

$$\frac{2\tan x}{1-\tan^2 x} = \frac{2\frac{\sin\alpha}{\cos\beta}}{1-\frac{\sin^2\alpha}{\cos^2\beta}}.$$

Then use $\cos^2\beta = \frac{1+\cos^2\beta}{2}$, $\sin^2\alpha = \frac{1-\cos^2\beta}{2}$, and express the right-hand side as a product.

2. If $\sin\alpha + \sin\beta = m$, and $\cos\alpha + \cos\beta = n$, show that $\frac{1}{n}\cos\frac{\alpha+\beta}{2} = \frac{1}{m}\sin\frac{\alpha+\beta}{2} = \frac{2}{m^2+n^2}\cos\frac{\alpha-\beta}{2}$.

Hint.—Express $\sin\alpha + \sin\beta$ and $\cos\alpha + \cos\beta$ each as a product, and divide one product by the other, and the first identity is established.

3. If PABCDEFG is a regular octagon, and O its centre, show that $PA^2 + PB^2 + PC^2 = 6{\cdot}OP^2$.

Hint.—$PA = 2OP\sin\frac{\pi}{8}$, and therefore $PA^2 = 4OP^2\sin^2\frac{\pi}{8}$. Similarly for PB^2 and PC^2, $\frac{2\pi}{8}$ and $\frac{3\pi}{8}$ taking the place of $\frac{\pi}{8}$. Now use $\sin^2\frac{\pi}{8} = \frac{1-\cos\frac{\pi}{4}}{2}$.

4. If $A + B + C = \pi$, show that

$$\cos\tfrac{1}{2}A + \cos\tfrac{1}{2}B - \cos\tfrac{1}{2}C = 4\cos\frac{\pi+A}{4}\cos\frac{\pi+B}{4}\cos\frac{\pi-C}{4}.$$

Hint.—Work as in Ex. 2, Art. 136, Hall and Knight.

By means of the formulæ used in the solution of triangles, namely—

(1) $a\cos B + b\cos A = c$; (2) $\cos A = (b^2+c^2-a^2) \div 2bc$; (3) $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$,

work the following, also taken from the last examination paper:—

Show that—

1. $\cos A + \cos B = \frac{a+b}{c}2\sin^2\frac{C}{2}$.

[Use (1) and $2\sin^2\frac{C}{2} = 1 - \cos C$.]

2. $a\cos A + b\cos B + c\cos C = (a+b+c)(\cos A + \cos B + \cos C - 1)$.

[Use (1).]

3. $a^2(\tan B + \tan C - \tan A) + b^2(\tan C + \tan A - \tan B) + c^2(\tan A + \tan B - \tan C) = 3(a^2+b^2-c^2)\tan C$.

[Use (1) and (3).]

4. $a^3\cos(B-C) + b^3\cos(C-A) + c^3\cos(A-B) = 3abc$.

Geometry.

Read Props. 1 to 6, Book VI.

The student may be interested in two articles by Professor Hill, in the September and November numbers of *The School World*, on Euclid's Fifth Book.

NOTES ON THEORETICAL MECHANICS.

BY F. CASTLE, M.I.M.E.,

Royal College of Science; Lecturer on Mechanics, Geometry, etc., Morley College, London; Author of "Elementary Practical Physics," etc.

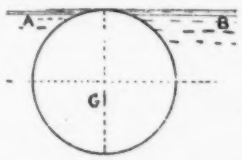
ADVANCED AND HONOURS STAGES.

(*Continued from p. 272.*)

Ex. 5. Find the centre of pressure of a plane circular area just immersed in water, with its plane vertical. (1885.)

The moment of inertia of a plane circular area about a line in its plane, and passing through the centre of area, is $\frac{\pi}{64}d^4$.

The moment of inertia of the area about a line parallel to the former touching the circle is (in the usual manner) equal to the



former, together with the area into the square of the distance between the axes.

$$\therefore I = \frac{\pi}{64}d^4 + \frac{\pi}{4}d^2\left(\frac{d}{2}\right)^2$$

$$= \frac{\pi}{64}d^4 + \frac{\pi d^4}{16} = \frac{5}{64}\pi d^4.$$

$$\therefore \bar{x} = \frac{I}{\bar{x}A} = \frac{\frac{5}{64}\pi d^4}{\frac{d}{2} \times \frac{\pi}{4}d^2} = \tfrac{5}{8}d.$$

Hence the distance from the line AB of G, the centre of pressure, is $\frac{5}{8}d$, where d is the diameter of the circle.

Ex. 6. Define the centre of pressure of a plane area. ABCD is a rectangle whose plane is vertical; draw the diagonal AC. If the rectangle is immersed with the edge AB in the surface of water, find the centre of pressure of the triangle ACD. (1892.)

Ex. 7. Find the depth of the centre of pressure of a triangle immersed in water, with one side in the surface.

If it were necessary to take account of the atmospheric pressure on the surface of the water, what steps would you take to correct your result? (1898.)

Ex. 8. Investigate the equations for finding the position of the centre of pressure of a plane area.

If the dimensions of an area are small in comparison with its depth below the surface, show that the centre of pressure is very nearly at the same depth as the centre of gravity. (1893.)

Ex. 9. Find the centre of pressure of a semicircle whose diameter is vertical, and the highest point of the diameter in the surface of the water. (1892.)

The reader will, we hope, not experience much difficulty in clearly realising the great difference in the behaviour of the so-called solids and fluids under pressure or force, and will see that it follows, as a direct consequence of the mobility of fluids, that when pressure is applied in any convenient manner to a fluid at rest, such as by a piston, or, in the case of a liquid, by means of a column of the liquid, then the pressure so exerted will be transmitted equally in all directions; also, the pressure exerted by the fluid on the surface with which it is in contact will be perpendicular to that surface.

The first statement may be proved by assuming a small cubical element in the fluid to become solidified; then as the element will still remain in equilibrium, the area of each face being the same, an equal force is exerted on each face; and as this remains true in whatever direction the cube is turned, it follows that the pressure is the same in all directions.

The pressure of the fluid at any point must be perpendicular to the surface; if not, then the pressure at any point could be resolved into two components—one perpendicular to the surface, the other parallel to it: the latter (on account of the assumption that the fluid is frictionless) would cause motion; but as the fluid is at rest, this latter component must be zero—that is, the pressure exerted by the fluid is everywhere perpendicular to the surface.

These two statements, together with the following, are very important, and will, when they are clearly made out, very much simplify the future work of a student in this subject.

Pressure.—The term "pressure" indicates usually the force exerted on unit of surface; or if P is the total pressure, and A the area of the surface, then when the pressure is uniform over the surface, the fraction $\frac{P}{A}$ is the pressure per unit area, or is the intensity of pressure.

Pressure at a point.—This term is used to designate *the pressure on unit area at the point*. When the pressure is variable, the pressure at a point may be obtained by considering the pressure exerted on an element of area at the point; or, in other words, a portion of the surface is taken so small that the pressure on it may be regarded as uniform. If this small area be denoted by a, and the intensity of pressure by p, then the pressure at the point is given by pa.

In dealing with the case of a curved surface, when the pressure at a point has been obtained, the horizontal and vertical components of the pressure may be found by the rule for the resolution of forces.

Also, in the questions which are usually met with in examination papers, some elementary knowledge of the mensuration of simple solids is assumed.

Ex. 1. If two liquids do not mix, show that their common surface is a horizontal plane. A conical vessel, with its base horizontal, is filled partly with water and partly with mercury. Internally the radius of the base is 6 inches, and the height 18 inches; the volume of the mercury is seven times that of the water. Find the pressure on the base, having given that a cubic inch of water weighs 250 grains, and a cubic inch of mercury 3400 grains. (1887.)

The upper part of the cone will be filled with water. This smaller cone we may call the water cone; its base will be parallel to that of the larger cone, and to obtain its volume we must obtain the radius of the base and the height.

Let r denote the radius of the base, and h the height.

Then $r : h = 6 : 18$.

$$\therefore r = \frac{6h}{18} = \frac{h}{3}.$$

$$\therefore \text{Volume of water cone} = \pi\left(\frac{h}{3}\right)^2 \times \frac{h}{3}$$

$$= \frac{\pi h^3}{27}.$$

To obtain the volume occupied by the mercury, it is necessary to subtract the volume occupied by the water.

$$\therefore \text{Volume of mercury} = \pi \times 6^2 \times \frac{18}{3} - \frac{\pi h^3}{27},$$

and the volume of the mercury is seven times that of the water.

$$\therefore \pi \times 6^2 \times 6 - \frac{\pi h^3}{27} = 7\pi\left(\frac{h^3}{27}\right).$$

$$\therefore \pi \times 6^2 \times 6 = \frac{8\pi h^3}{27}.$$

$$\therefore h^3 = 27 \times 27,$$

$$\text{or } h = 9.$$

Hence the line of separation of the mercury and water is at a distance of 9 inches from the base.

$$\therefore \text{Pressure on the base} = 9(250 + 3400)$$

$$= \underline{32850} \text{ grains per sq. in.}$$

Total pressure on the base is obtained by multiplying area of base by the intensity of the pressure.

$$\text{Area of base } \pi \times 6^2 = 113{\cdot}09 \text{ sq. in.}$$

$$\therefore \text{Total pressure} = 113{\cdot}09 \times 32850$$

$$= 3715006{\cdot}5 \text{ grains}$$

$$= 530{\cdot}7 \text{ lbs.}$$

Ex. 2. What is meant by the pressure of a fluid at a point?

A is the highest point of the vertical diameter of a sphere, radius 3 feet; C is the centre of the sphere, and P is a point on the inner surface such that PCA is 120°. Find the horizontal and vertical components of the pressure at P in pounds per square foot. One cubic inch of water weighs 252 grains. (1894.)

Draw the vertical diameter AB and PD perpendicular to AB; then $AD = \frac{3}{2}r$, where r is the radius of the sphere.

$$\therefore \text{Pressure at P} = 1 \times \frac{3}{2}r \times w,$$

where w is the weight of unit volume.

$$\therefore \text{Horizontal component at P} = \frac{3r}{2}w \times \cos 30°$$

$$= \frac{3 \times 3 \times 252 \times 1728 \times \sqrt{3}}{4 \times 7000} = 242{\cdot}1 \text{ lbs.}$$

$$\text{Vertical component at P} = \frac{3}{2}r \times w \times \sin 30°$$

$$= \frac{3 \times 3 \times 252 \times 1728}{4 \times 7000}$$

$$= \underline{139{\cdot}97 \text{ lbs.}}$$

Next Month:

NOTES ON ADVANCED AND HONOURS PHYSIOLOGY FOR THE MAY EXAMINATIONS.

By WALKER OVEREND, M.A., M.D.

REPLIES TO SCIENCE QUERIES.

Omega—(*continued*).—THE EYE. Before reaching the retina, the incident light is refracted—

1. At the anterior surface of the cornea. As the refractive index of the aqueous humour is very nearly equal to that of the cornea, the refraction at the posterior surface of the cornea may be neglected.
2. At the anterior surface of the crystalline lens.
3. At the posterior surface of the crystalline lens.

The total effect of these three refractions may be represented by the action of a single lens with different media on its opposite sides. Hence, if we know the two principal foci, the two principal planes, and the two nodal points corresponding to this equivalent optical system, we may easily effect a graphical construction for the size of an image on the retina.

Fig. 5 is a scale drawing of the optical system corresponding to the normal eye. F_1 and F_2 are the first and second focal points, P_1 and P_2 are the first and second principal points (being the intersections of the axis with the first and second principal planes), and N_1 and N_2 are the first and second nodal points.

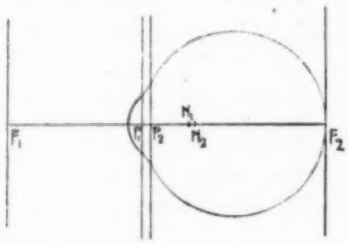


FIG 5

In order to determine the size of the retinal image when the nodal points are given, the construction shown in Fig. 6 may be followed.

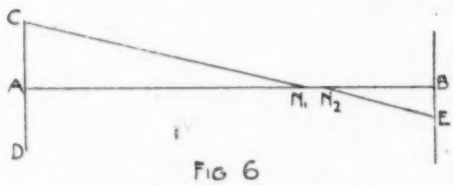


FIG 6

Let the line AB represent the axis of the eye, N_1 and N_2 being the nodal points, and the plane passing through B perpendicular to AB being tangential to the retina at B. Let CD represent any object, of which the centre point A is situated on the axis AB. Let N_1 and N_2 be the first and second nodal points of the optical system equivalent to the eye. Then a ray of light from C directed to N_1 will, after refraction, appear to proceed from N_2 parallel to CN_1. Draw N_2E parallel to CN_1; then E will be the point of the image which corresponds to the point C of the object.

Since CN_1 is parallel to N_2E, and AN_1 is continuous with N_2B, the triangles CN_1A and EN_2B are similar.

$$\therefore \frac{EB}{BN_2} = \frac{CA}{AN_1}.$$

$$\therefore EB = BN_2 \frac{CA}{AN_1}.$$

In the problem which has given rise to this discussion, the radius of the disc = AC = 15 cms.

The first nodal point, N_1, is not given; but as it is close to the cornea, we may take AN_1 as the distance of the disc from the eye = 200 cms.

Distance BN_2 = 15 mm. = 1·5 cms.

$$\therefore \text{Radius of circular image} = EB = 1{\cdot}5 \times \frac{15}{200} = {\cdot}112 \text{ cms.}$$

Area of circular image = $\pi \times ({\cdot}112)^2 = {\cdot}0397$ sq. cms. (nearly).

Glaswegian.—The fact that though you were self-taught you passed in mathematics in the final B.A. indicates that you possess a decided aptitude for mathematics. The difficulty in the pure mathematics for B.Sc. lies in the indefiniteness of the syllabus and the absence of any text-book entirely covering the ground. We have known students who have received a systematic mathematical training and have yet failed in this subject in the B.Sc. Bear this in mind in making your choice. Perhaps your best method will be to attempt a set of pure mathematical papers, and see how you get on.

Greenhill's *Calculus* is a satisfactory book. You may have to refer to other works for particular problems, etc., but the same would apply to other text-books.

R.E.D.—For magnetism and electricity you cannot do better than apply yourself vigorously to the study of S. P. Thompson's *Electricity and Magnetism* (Macmillan), whilst for advanced theoretical chemistry we recommend you to study Newth exclusively.

It is difficult to answer your question as to time, but three hours' practical work per week for a year ought to see you well able to do all that is required of you. Newth's *Lecture Experiments* is now published at 6s. You will find it of little use to you in preparing for the examination in question.

Third Year P.T.—The steel bar would show no change in weight when magnetised; hence magnetism is not matter, whatever else it may be. The bar would arrange itself, roughly, in a north and south direction, but not exactly so, thus showing that the magnetic poles of the earth are not identical with the geographical poles. Any text-book (see "*Section One*" *Physiography*, Nelson, pp. 206 *et seq.*) will give other proofs of this. It is the simplicity of the question that makes it appear difficult.

Glass Making (*Hyderabad*).—You will find the following works useful: *Glass Manufacture*, by H. Chance; *Glass Manufacture*, by H. S. Harris; *Glass Manufacture*, by H. Powell—all published by Bell, London, at 3s. 6d. each.

Anxious.—The text-books recommended for Physiology are—Foster and Shore's *Physiology for Beginners*, Huxley's *Lessons on Physiology* (Macmillan), or *Elementary Physiology*, by B. Moore, M.A. (Longmans). For the Advanced Stage, either Jeo's *Manual of Physiology* (Churchill), or Kirke's *Handbook of Physiology*, edited by Professor Halliburton, 14th edition (Murray), will be found useful. Starling's *Elementary Physiology* (Churchill) is a helpful and suggestive book. Trotter and Firth's *Practical Domestic Hygiene* (Longmans) and Willoughby's *Principles of Hygiene* (Collins) are suitable for the Elementary and Advanced Stages of Hygiene. The Syllabus of Physiology and Hygiene, also Science Examination Papers, may be obtained from Eyre and Spottiswoode, East Harding Street, Fleet Street, London, E.C., directly, or through any bookseller.

OUR FRENCH AND GERMAN PRIZE COMPETITION.

Prize Editor—W. T. THOMPSON, B.A. (LOND.), *French and German Honours.*

RULES.

(*See previous Numbers.*)

FRENCH PRIZE COMPETITION.

A Prize of One Guinea will be given for the best translation into English of the following extract:—

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THE EDITOR'S TABLE

AIDS TO GEOGRAPHICAL TEACHING.

In no subject do the matter and means of instruction require more frequent revision to bring them abreast of the time than in geography. Owing to the rapid changes continually taking place, text-books and maps speedily deteriorate in value by becoming out of date. We are glad to call attention to some of the most recent works on this remarkably progressive subject.

Descriptive Geography, by Samuel Brook (Thomas Nelson and Sons), is a very comprehensive text-book for pupil teachers, Scholarship, Certificate, and Matriculation candidates. Opportunity has been taken, on the issue of an eighth edition, to have this book thoroughly revised and brought up to date by incorporating all the most important of recent changes. Improvement has also been effected by some rearrangement of the matter, by the addition of new sketch-maps, and by the adoption of new type of a clearness that makes reading the book a real pleasure. The compact and clear manner of statement has enabled the author to include an astonishing amount of information in the six hundred and odd pages of his work.

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A Geographical Handbook to the Map of South Africa is published by the same firm, and gives in a very concise form a multitude of details respecting the geography of the lands included under the term South Africa. As the Handbook is very cheap, it might well be adopted as a text-book for any class studying this portion of geography.

The Unrivalled Atlas of Modern Geography. (W. and A. K. Johnston.) A work of this kind, in its twenty-second edition and two hundred and twentieth thousand, scarcely needs commendation. For any one not acquainted with it we may say that it contains forty large quarto full-page coloured maps and diagrams, with some explanatory letterpress, and an index of twenty-two thousand places marked on the maps. Produced in the excellent style of the publishers, this atlas is very suitable for pupil teachers and elder scholars.

A Geography of Africa. By Lionel W. Lyde, M.A. (A. and C. Black.) The author of this book has had long and varied experience as a teacher and examiner of geography. This experience has determined the form and character of this excellent text-book, and others of the series to which it belongs. No maps are included, but the use of an atlas is enjoined as an absolutely necessary part of effective study. Exact heights and distances and lists of unimportant places are not given, because they burden the memory uselessly, and often involve neglect of more valuable matters. Mr. Lyde treats geography as a rational study of living interest, and in his crisp paragraphs contrives to embody in impressive form the mutual bearing of facts—the relation of geographical features and phenomena to conditions of life. The method of comparison is largely and effectively used. Altogether the book may be commended as an interesting and thoroughly educational text-book. Our space does not allow of quotation, or we should like to illustrate the manner of the writer by quoting from the chapters on the Congo, the Niger, the Nile, and the Zambesi.

Man and His Work. By A. J. Herbertson, Ph.D., and F. D. Herbertson, B.A. (A. and C. Black.) Rightly described on the title-page as "An Introduction to Human Geography," this book treats of the earth, in a very special manner, as the home of mankind. Throughout the authors seek to show how such geographical features as soil, surface, climate, etc., influence the occupations of man, and his manner of life in different regions of the earth. They also show incidentally how human agencies in some measure react on the earth, and modify the conditions of life. All this is done by employing the concrete method, describing actual circumstances, and basing the information on the original narratives of travellers and observers. Great skill is shown in the progressive arrangement by which we pass from life on the frozen desert to that in the temperate forest lands, in the steppes, the hot deserts, and the equatorial forests. Later chapters deal with the "Rise of the Arts," the "Development of Manufactures," "Trade and Transport." We know of no popular volume in which this rational method of treating geography is so effectively embodied. It gives a new distinction to the school series in which it appears—the series so ably edited by Mr. Lyde, and so admirably, as well as cheaply, produced by Messrs. Black.

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Among aids to geographical teaching we may very properly include photographs of places and lantern slides, for we know that the photographic album of views and the magic lantern are both very largely used to illustrate lessons on geography. Messrs. G. W. Wilson and Co. of Aberdeen have sent us some beautiful specimen views of English and Scotch scenery. Cabinet scraps, measuring eight inches by six, and album scraps, five inches by four, are both suitable for mounting in an album. Their large permanent photographs, twenty-four inches by eighteen, to judge by a specimen view of High Street, Oxford, are wonderfully good, and, suitably framed, would be eminently appropriate for school decoration.

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We have noticed a further direction in which the teacher of geography may look for materials to assist him: we refer to the missionary magazines which many Sunday scholars and others have the opportunity of reading. From the Church Missionary Society we have received a parcel of their periodicals—**The Church Missionary Intelligencer, Mercy and Truth,** a record of medical mission work, **The Church Missionary Gleaner,** and **Awake,** the last two specially for young people. Of the several numbers before us there is scarcely one which would not afford, in the shape of topographical descriptions, pictures, and sketch-maps, useful material for the illustration of lessons in geography. There is, of course, a higher purpose which this kind of literature is intended to serve; but it hardly falls within our province to dwell on that side, beyond noticing that in the rational teaching of human geography as in missionary narratives, occur opportunities of impressing on young minds the great lesson of the brotherhood of man.

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We have also received several specimens of Messrs. Hachette's Toy and Picture Book Series—namely, **Dix Petits Nègres Noirs, L'Alphabet de Pierrot, La Mère l'Oie**, and **Jacques sans Mémoire et Zigotot l'étourdi**. All are prettily produced in colour, and well in keeping with their other handsomely-bound and beautifully-illustrated volumes issued this year.

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Cæsar, Gallic War, Books IV., V. Edited by J. F. Davis, D.Lit., M.A. This little text-book is well and clearly printed, but the book does not open well. The introductions contain a life of Cæsar, sections on the Gauls, the Romans and the Gauls, the Roman army, and the Roman camp. The notes, which are very short, consist mostly of aids to translation and comments on grammatical points. There is a clear map of Gaul, and the vocabulary is well done.

Student's Handbook for French Examinations. By J. Belfond. French examinations are still with us; and so long as they remain, and are conducted in their present manner, so long will there be room for such little books as the above. This book is meant to enable the student to resist the attacks of examiners who expect him to know facts of such trifling importance as that *le scholie* means a "scholium (geometry)," while *la scholie* means "scholium, commentary." The book includes a useless list of verbs representing the cries of animals, many of which are unknown to the natives of France, and should therefore not be required in a French examination. Any attempt to master the twelve pages of homonyms can only result in disgusting and discouraging the student.

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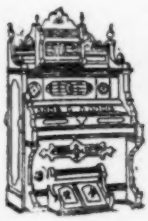

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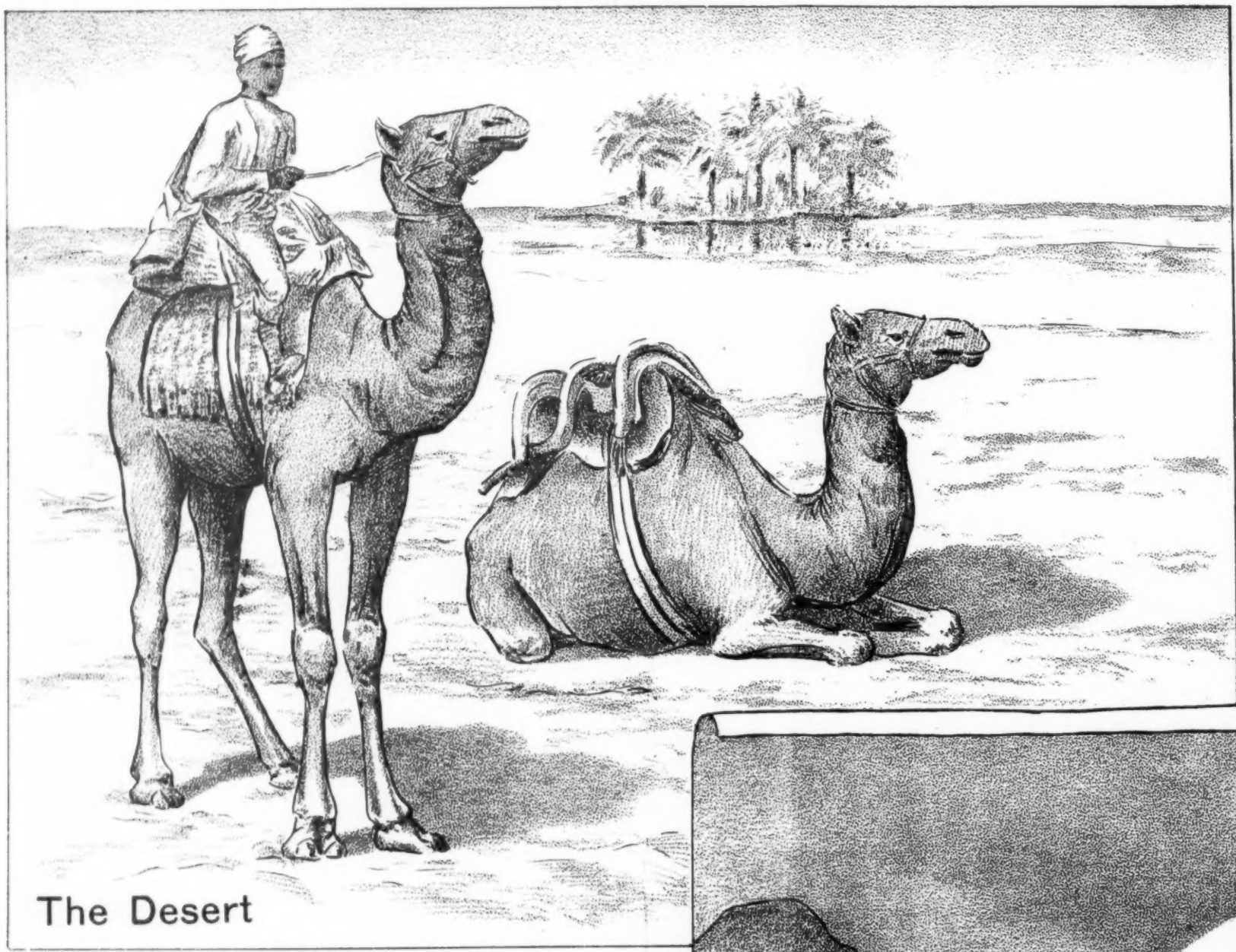

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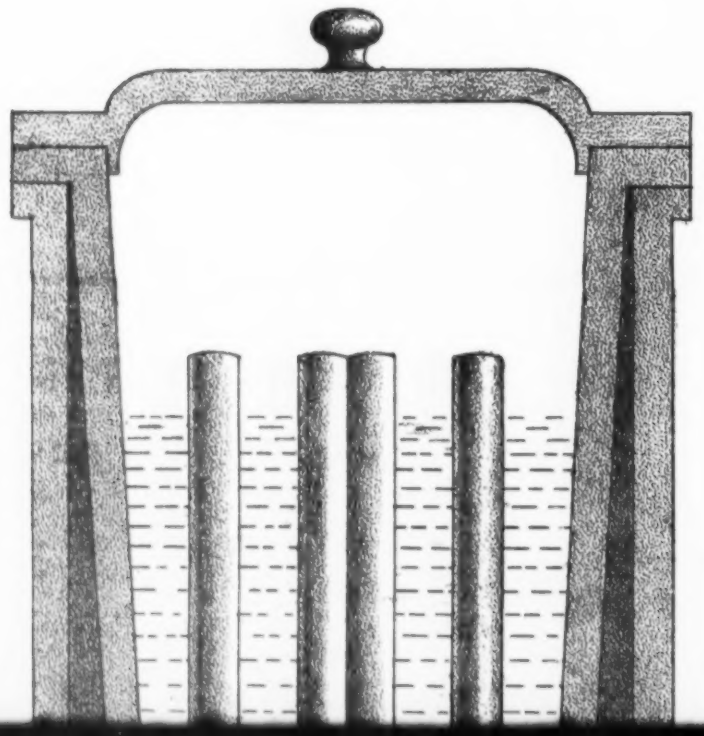

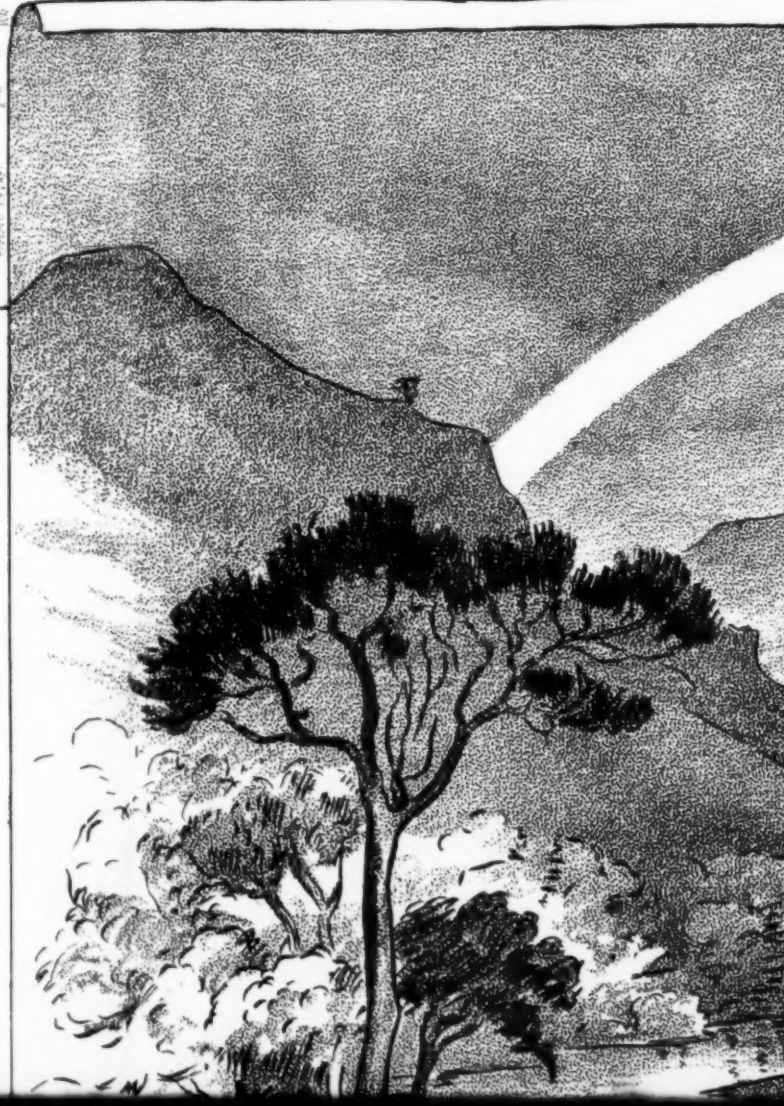

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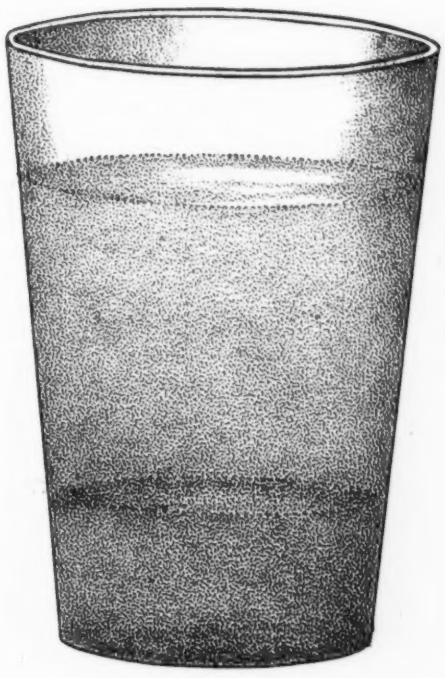

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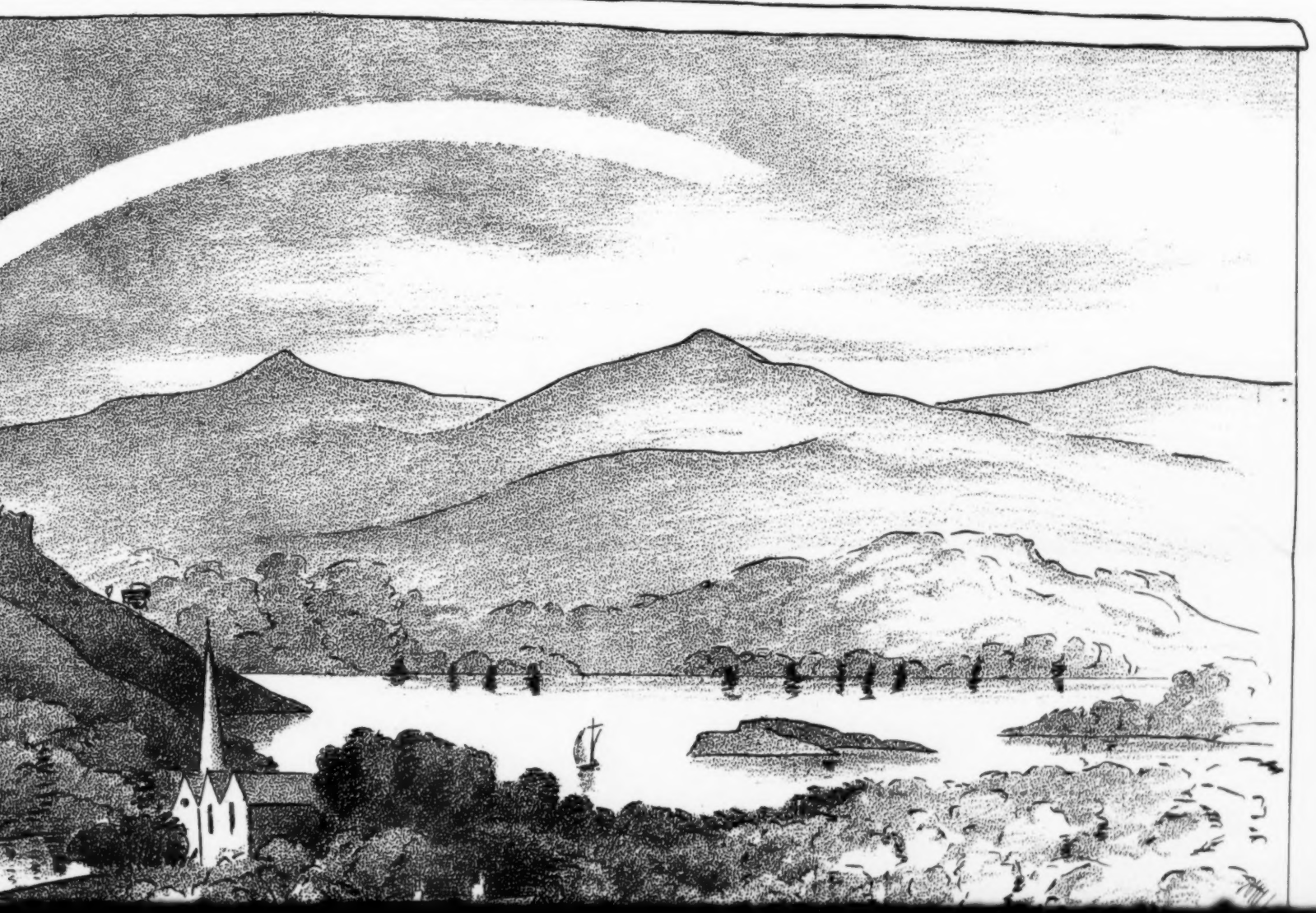

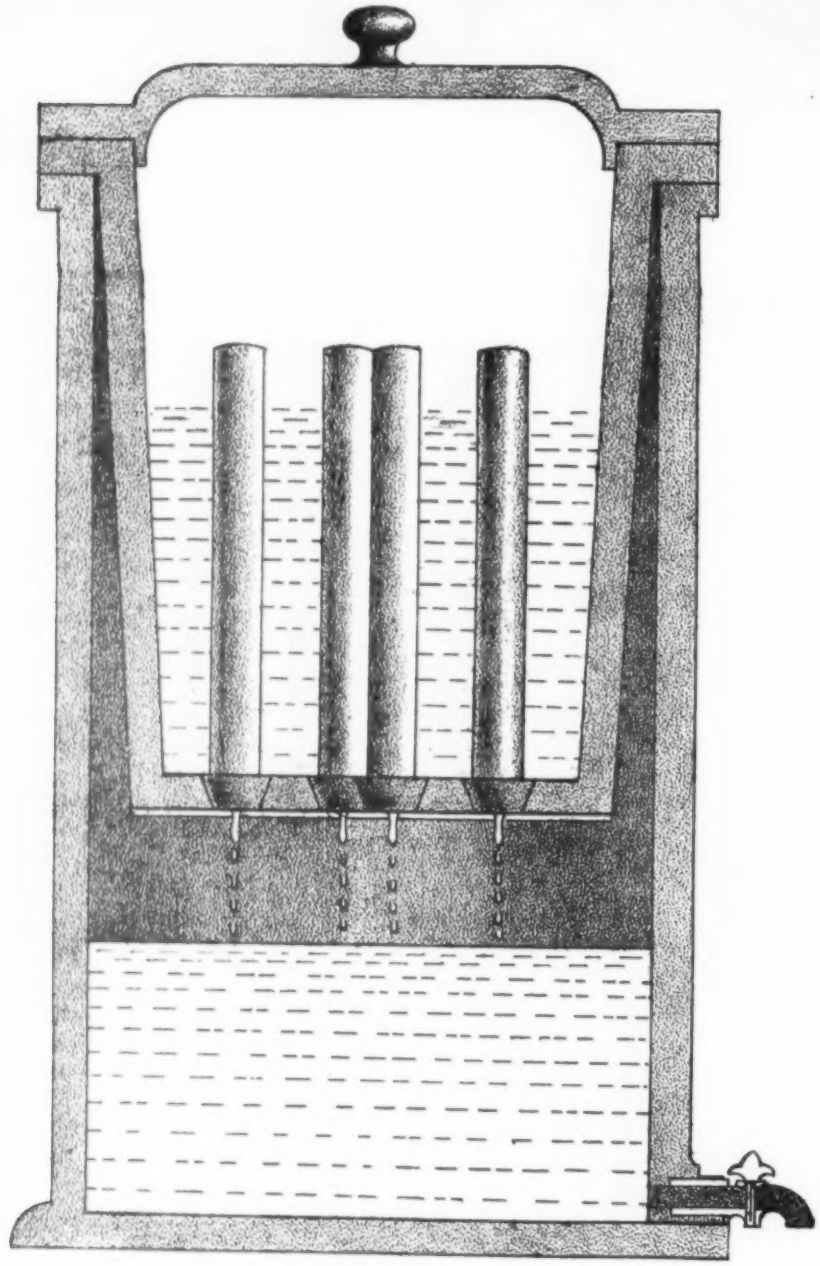

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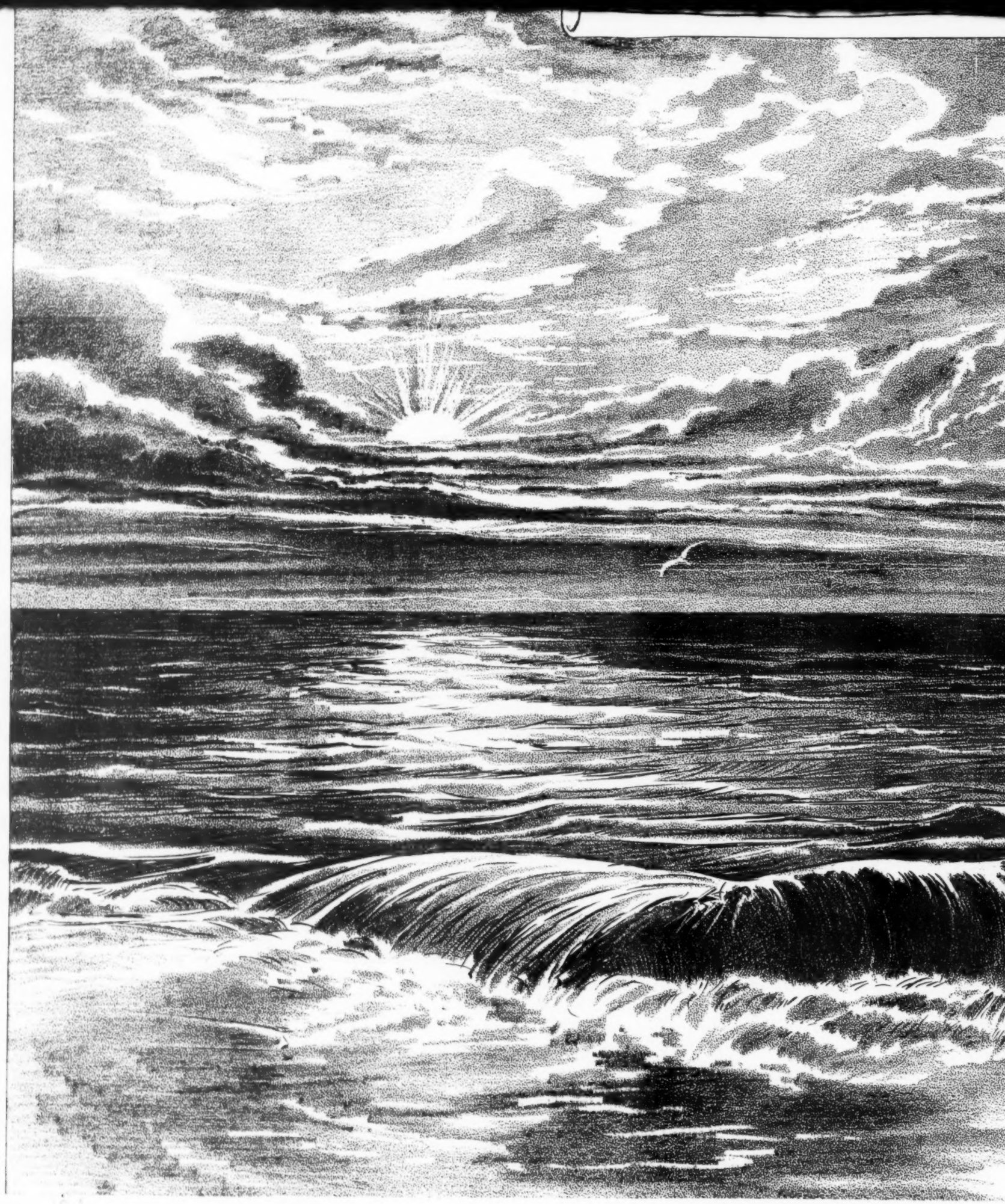

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